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The Angling Fishery of the Lower Red River

By Lysack, W. 1986

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Natural Resources
Fisheries

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INTRODUCTION

The intensive sport fishery for many species of fish occurring in the lower reaches of the Red River has not been characterized in spite of the fact that it has long been considered as one of Manitoba's largest and most important recreational fisheries.

A creel survey of anglers exploiting the Red River from the St. Andrews locks at Lockport to the mouth of Netley Creek (Fig. 1) was conducted during the open water season and winter of 1982. The objectives of this survey were:

1. To quantify spatial and temporal changes in species specific numbers and weights of fish harvested from the river.
2. To quantify spatial and temporal changes in angling effort.
3. To describe the age structure and growth regimes of commonly angled species.
4. To examine if relationships exist between walleyes and saugers angled in the Red River and netted by commercial fishermen in southern Lake Winnipeg.

Stationary creel surveys were executed at four access points from May to October, 1982. A roving survey of the winter fishery on the Red River was conducted from December, 1982 to March 1983. Fish harvests, not catches were determined during this survey. Numbers and weights of fish caught and returned to the river were not determined.

A stratified random sampling scheme was used to estimate species specific catch per unit of effort, CUE, and total angling effort during the open water period.

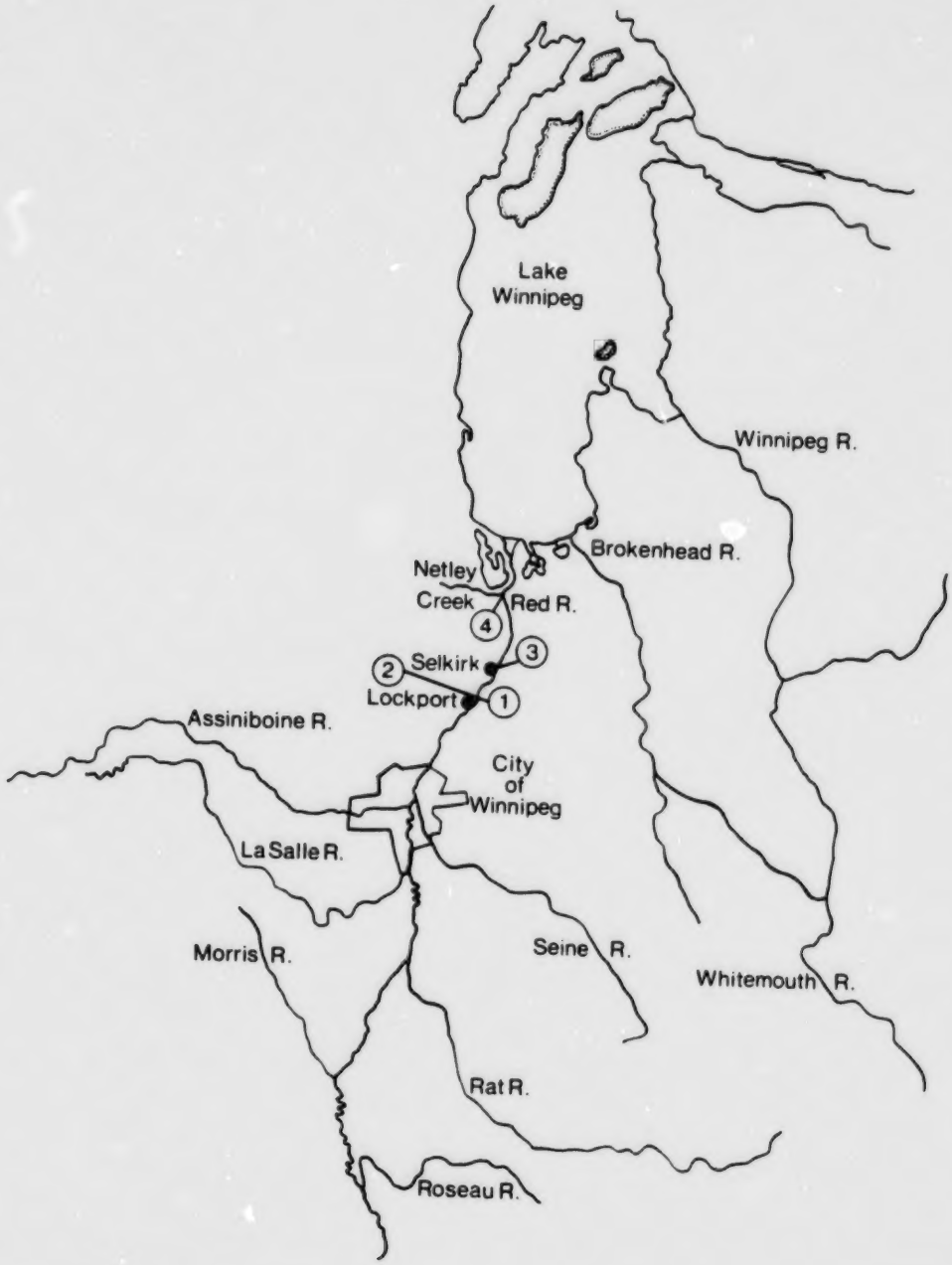


Fig. 1. Locations of sampling stations: 1 - east Lockport, 2 - west Lockport, 3 - Selkirk, 4 - Netley Creek.

Carlander et al. (1958) advocated the utility of statistically sound sampling schemes to provide reliable (unbiased) estimates of angling CUE values. Robson (1960) mathematically described the application of stratified random sampling to estimation of angling CUE. This method depended on passively sampling anglers at stationary points after the anglers had finished fishing. This method was applicable to the Red River case because only a few access points were present, most anglers remained in one area and it was easy to estimate total fishing effort in each area. Robson (1961) also described a method of using a stratified random sampling scheme to estimate total effort and catches from roving creel survey data. This method provides reliable estimates only if CUE actively sampled from incompleted fishing durations is an unbiased estimate of CUE passively determined from complete fishing durations. A logistical translation of Robson's (1960) method was provided by Regier (1966). Regier (1971) discovered that a Peterson mark-recapture method may be used to estimate anglers catches in a large, complex system. Angler CUE estimates were related to environmental variables in American reservoirs by Jenkins and Morias (1971). Malvestuto et al. (1978) used coefficients of variation for monthly estimates of catch and effort data to measure sampling design precision which they found to vary temporally.

Steinnes and Raab (1983) examined the utility of past success in predicting angling activity. Schlesinger and McCombie (1983) evaluated climatic, morphoedaphic and effort indices as predictors of angling yields. Shuter et al. (1986) discussed the utility of creel survey data in assessing population behaviour of lake trout and smallmouth bass.

METHODS

The Red River creel survey was comprised of two sampling seasons. The open water season was sampled from May 15 to October 30, 1982 and the winter season was sampled from December 16, 1982 to March 11, 1983. Sampling was confined to the lower reaches of the Red River from the St. Andrews locks at Lockport to the mouth of Netley Creek (Fig. 1).

Anglers leaving the river were sampled at the four major access points during the open water season: east Lockport (station 1), west Lockport (station 2), Selkirk (station 3) and Netley (station 4). A roving creel survey during the winter season covered the same three areas: Lockport, Selkirk and Netley.

The creel survey conducted during the open water season conformed to the stratified random sampling method described by Cochran (1977). Sampling schedules at Lockport, Selkirk and Netley were independent of each other. The lack of preliminary creel data precluded the application of optimum sampling allocation.

For each of the four stations, a population of N days was divided into strata for N_1, N_2 ...N_h days so that $\sum_{i=1}^{h} N_h = N$. Values of N for each station, stratum types stratum sizes and sample sizes (n_h) are listed on Table 1.

During the open water season, the daily sampling routine at each of the four stations consisted of the following activities:

A sampling crew arrived at the parking lot at approximately 8 a.m. and began intercepting anglers returning from their daily fishing

Table 1. Types and sizes of strata and numbers of sampling days at four creel survey stations during the open water period on the Red River, 1982.

Stratum type	Location											
	East Lockport			West Lockport			Selkirk			Netley		
	Stratum no.	N_h (days)	n_h (days)	Stratum no.	N_h (days)	n_h (days)	Stratum no.	N_h (days)	n_h (days)	Stratum no.	N_h (days)	n_h (days)
May weekday	1	10	2	12	10	4	24	10	5	36	10	5
May weekend	2	7	5	13	7	5	25	7	5	37	7	5
June weekday	3	22	12	14	22	13	26	22	17	38	22	15
June weekend	4	8	4	15	8	4	27	8	4	39	8	4
July weekday	5	21	14	16	21	14	28	21	15	40	21	12
July weekend	6	10	4	17	10	4	29	10	4	41	10	4
August weekday	7	21	13	18	21	13	30	21	12	42	21	14
August weekend	8	10	2	19	10	2	31	10	2	43	10	2
September weekday	9	21	1	20	21	11	32	21	13	44	21	9
September weekend	10	9	1	21	9	1	33	9	4	45	9	2
October weekday	11	11	1	22	20	3	34	20	4	46	20	2
October weekend				23	11	2	35	11	3	47	11	2
		N=150	n=59		N=170	n=76		N=170	n=88		N=170	n=76

expeditions. During the day, a minimum of three counts of all visible boat and shore anglers and the time of the count were recorded. At some stations, boat anglers were not always visible. In this case, numbers of boat trailers in the parking lot and counts of numbers of anglers per boat were monitored. The following data were collected from each individual or group that volunteered to be interviewed: date, station, number of anglers in the group, angling duration (hours), species specific harvested numbers, individual fork lengths (mm), individual weights (gm$\pm$5 gm) and a structure from each fish for age determination. Scales were collected from all species except channel catfish, burbot and bullheads. Scales were removed from an area anterior to the dorsal fin and above the lateral lines. The anterior first four or five spines were removed from the dorsal fins of walleyes, saugers, freshwater drum, rock bass, white bass and perch. The large fin spine was collected from catfish and bullheads. Pectoral fin rays were collected from pike, suckers and burbot. A cleithrum was collected from each pike.

During the winter season, daily roving surveys were conducted at Lockport, Selkirk and Netley. Total numbers of anglers at each area were counted once. Data collected from individuals or groups included angling duration, numbers of anglers in the group and species specific harvested numbers and individual weights. Lengths and ageing structures were not collected.

Scales were examined at 24X and 48X using a microfiche reader. 0.5 mm sections of spines and fin rays were viewed at 72X. Pike cleithrae were cleaned and aged at 12X under a stereomicroscope.

Total angling effort exerted during each sampling day at each station was estimated by integrating the curve of numbers of observed

anglers plotted versus the times of observations. For each effort curve, it was assumed that no angling occurred between midnight and 6 a.m. In some instances, points on the daily effort curve represented the number of shore anglers and the number of boat trailers times the mean number of people per boat.

Cochran's (1977) notations and formulae were used to derive stratified random estimates of species specific CUE values in terms of numbers and weights:

N= population of days

h= stratum (subscript)

st= stratified (subscript)

i= day in a stratum

n_h= number of sampled days in stratum h

N_h= total number of days in stratum h

y_{ih}= attribute value for the i^{th} day in the h^{th} stratum

$W_h = \frac{N_h}{N}$, stratum weight

$f_h = \frac{n_h}{N_h}$, sampling fraction

$$g_h = \frac{N_h(N_h - n_h)}{n_h}$$

$$\bar{y}_h = \frac{\sum_{i=1}^{n_h} y_{ih}}{n_h} \text{ , sample mean}$$

$$s_h^2 = \frac{\sum_{i=1}^{n_h}(y_{ih} - \bar{y}_h)^2}{(n_h - 1)} \text{ , within stratum sample variance}$$

$\bar{y}_{st} = \sum_{h=1}^{h} W_h \bar{y}_h$, stratified mean

$\hat{V}(\bar{y}_{st}) = \sum_{h=1}^{h} W_h^2 \frac{s_h^2}{n_h} (1-f_h)$, variance of $\bar{y}_{st}$

$\hat{T} = N \bar{y}_{st}$, attribute value for N days

$\hat{V}(\hat{T}) = N \hat{V}(\bar{y}_{st})$, variance of $\hat{T}$

$C.I.(\hat{T}) = t\sqrt{V(\hat{T})}$, confidence interval for $\hat{T}$

$$d.f. = \frac{(\Sigma g_h s_h^2)^2}{\frac{\Sigma g_h^2 s_h^4}{n_h - 1}}$$, degrees of freedom required to determine t in $C.I.(\hat{T})$

Total catches per sampling day were estimated by the product of CUE and total effort per sampling day.

Total effort per sampling day during the winter season was estimated by the product of total number of observed anglers and mean angling duration at each location.

Other statistical analyses were performed according to Snedecor and Cochran (1967).

RESULTS

Open water survey

Stratified random sampling CUE values in terms of species specific numbers and weights are listed in Appendix A. Species specific total catch estimates are listed in Appendix B. Throughout this report, CUE and total catch values represent fish that were harvested, not fish that were caught and released.

Daily total fishing effort was characterized by two methods: plots of observed effort on weekday and weekend sampling days (Fig. 2) and stratified random estimates of daily angling effort (Fig. 3). Mean angling duration remained relatively stable throughout the open water season and did not differ between weekends and weekdays except at Selkirk during the fall (Fig. 4).

The descriptive statistics of the total daily effort values (Table 2) listed on Table 3 indicate that total daily effort was lower on rainy days than on sunny days at all stations except Netley Creek. The Selkirk area received the highest effort while Netley Creek received the lowest effort. Frequency distributions of angling effort are generally bimodal. The second peak in these distributions is associated with higher amounts of effort exerted on weekends (Appendix c).

Attempts to relate daily angling effort to the daily amount of rainfall using least squares regression (LSR) were futile. Rankit plots of angling effort per station, amounts of rainfall and residuals from the LSR relating effort to amount of rain indicated non-normal distribution of all three parameters (Appendix C).

An ANOVA employing a nested design revealed that differences in angling effort exerted on Saturdays and Sundays were not significant ($F = 4.25$, $d.f. = 1.5$, $p = 0.05$). However differences in effort among

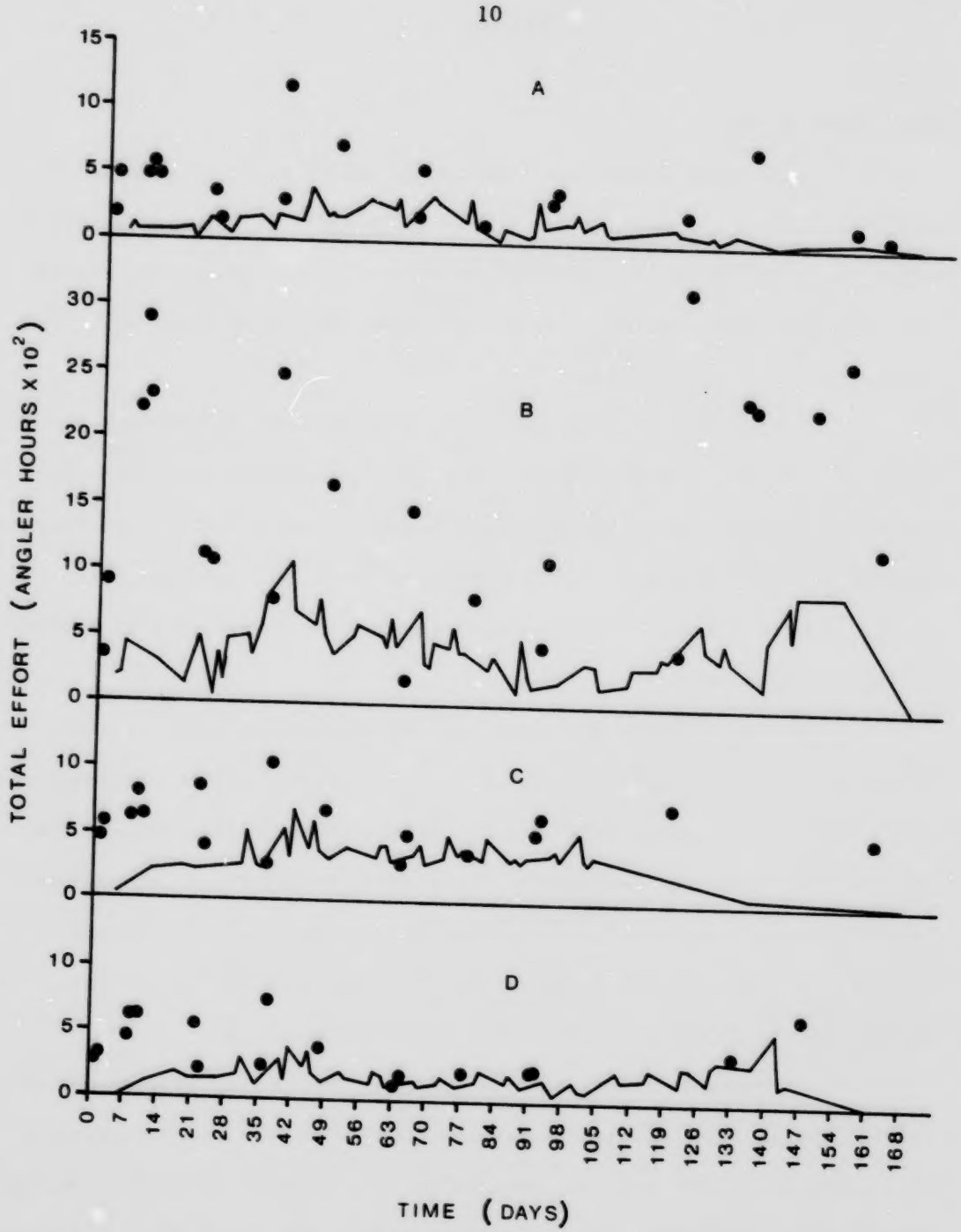


Fig. 2. Angling effort observed on weekend (●) and weekday sampling days at Netley Creek (A), Selkirk (B), east Lockport (C) and west Lockport (D).

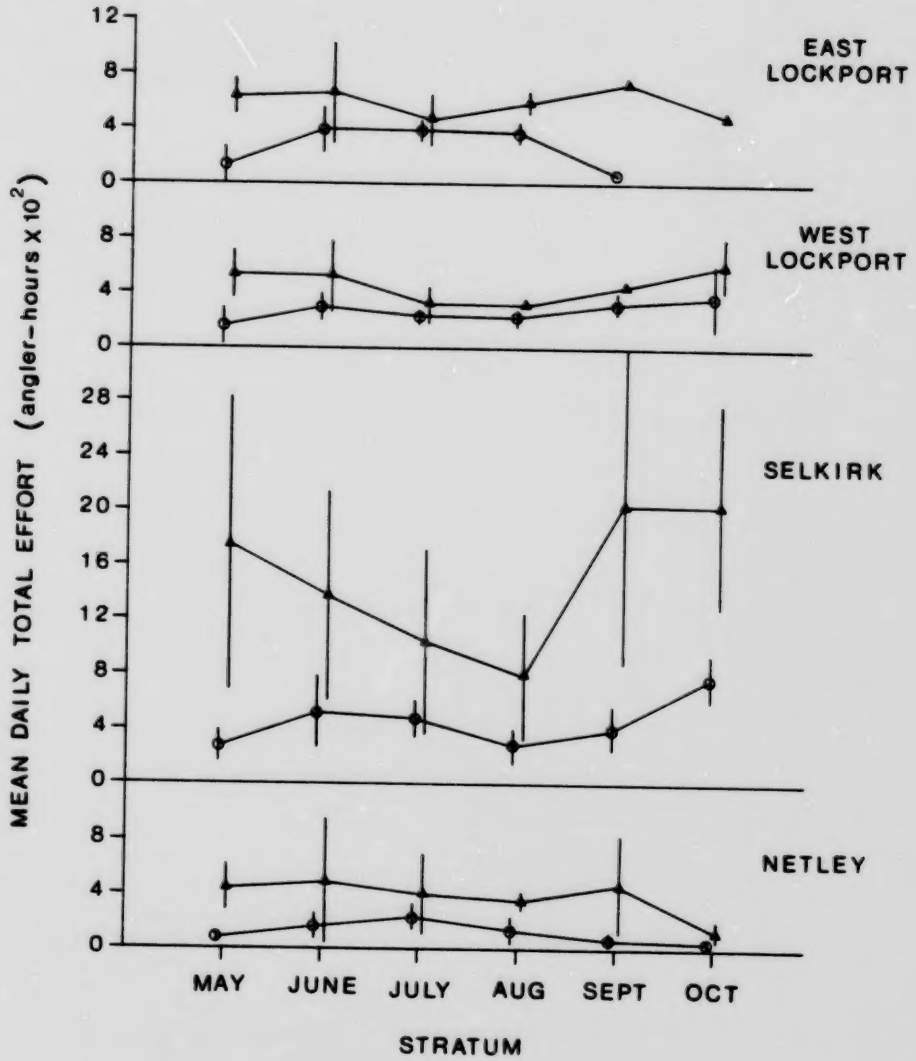


Fig. 3. Stratified random estimates of daily angling effort exerted during weekends (▲) and weekdays (O). Vertical bars represent 2 standard errors.

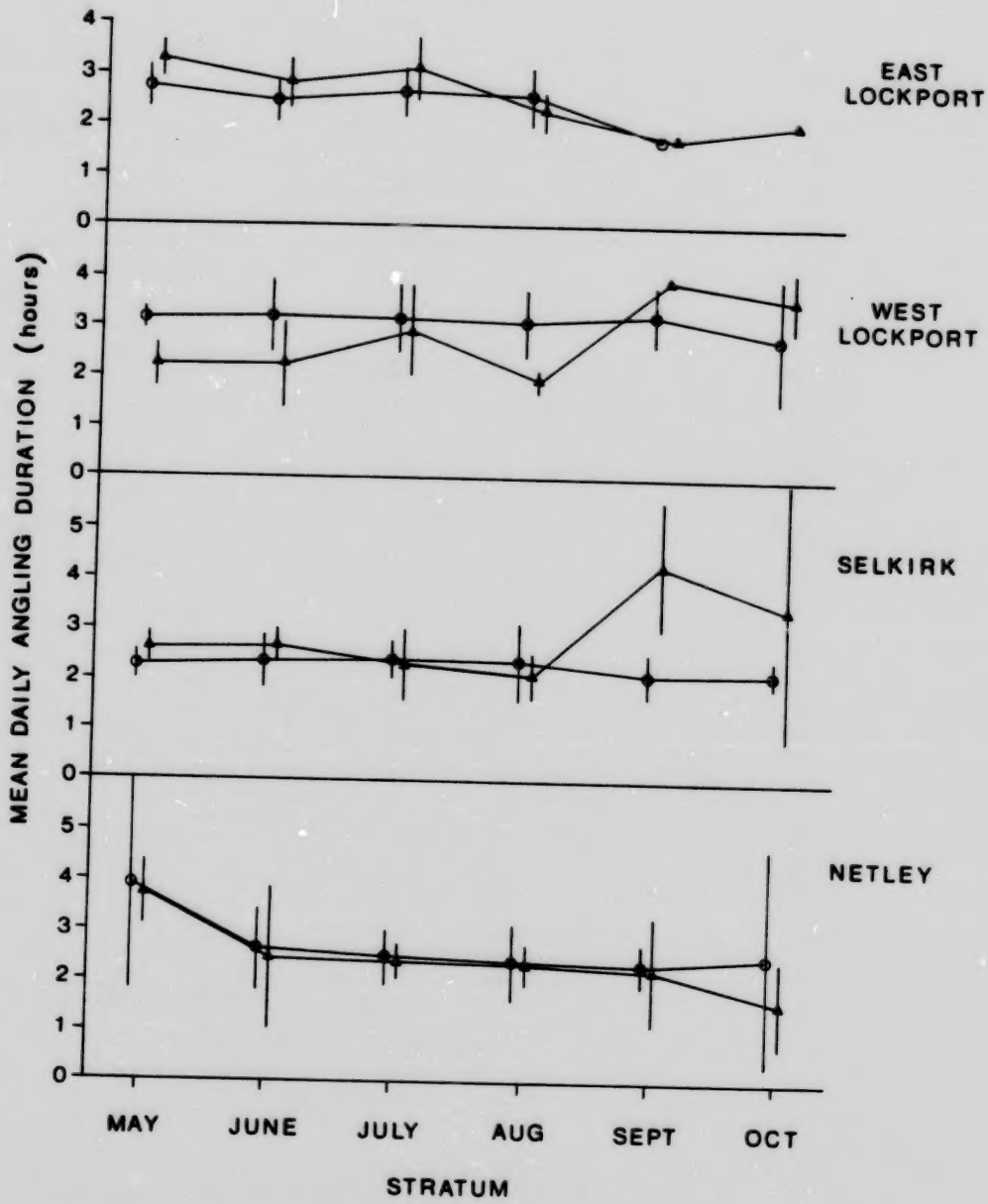


Fig. 4. Stratified random estimates of mean daily angling duration during weekends (▲) and weekdays (O). Vertical bars represent 2 standard errors.

Table 2. Total daily effort and daily amounts of rain on sampling days at the four creel survey stations.

Day	Date	Amount of rain (mm)	Effort (angler - hours)			
			East Lockport	West Lockport	Selkirk	Netley
1*	May 15	7.6	472	356	369	189
2*	16	.6	585	390		477
3	17	1.2				
4	18	.4			198	60
5	19	tr.	36	39	225	117
6	20				441	63
7	21					
8*	22		635	541	2232	492
9*	23		813	693	2904	579
10*	24		645	699	2340	480
11	25					
12	26	214	191	315		
13	27					72
14	28					
15*	29	.2				
16*	30	.6				
17	31	3.8			183	93
18	June 1	tr.	245	277	138	15
19	2					
20	3					
21	4	.2	226.5	217.5	492	168
22*	5	2.0	872	631	1116	366
23*	6	34.9	428	298	1090.50	147
24*	7	1.9			60	
25	8				373.5	45
26	9	4.6			171	
27	10	.4		224	498	171
28	11	tr.			490.5	157.5
29*	12	.2				
30*	13	tr.				
31	14		274	263	525	177
32	15		503	379	364.5	162
33	16	1.2				
34	17		261	237	594	87
35	18	tr.	236	178	789	189
36*	19	4.8	290	340	795	309
37*	20	4	1043	820	2484	1152
38	21					
39	22					
40	23	2.2	538	374	1062	144
41	24	.3	322	233	693	247.5
42	25		683	475	687	381
43*	26	1.1				
44*	27					
45	28	tr.	393	321	585	186

Table 2. Cont'd.

Day	Date	Amount of rain (mm)	Effort (angler - hours)			
			East Lockport	West Lockport	Selkirk	Netley
46	June 29		592.5	429	783	207
47	30		376	272	528	180
48*	July 1		692	481	1665	723
49	2	21.8	310	206	375	189
50	3					
51	4	.6				
52	5	17.6				
53	6		409	287	516	279
54	7		397	242	603	312
55	8					
56	9	tr.				
57*	10					
58*	11					
59	12		335	199	508.5	249
60	13	4.4	422	293.5	429	321
61	14		421	269	645	114
62	15	tr.	303	186	444	
63	16	23.9				
64*	17	.6	275	205	201	195
65*	18		493	266	1473	543
66	19					
67	20		367	224	714	342
68	21		428	241	315	303
69	22	.4	282	189	279	
70	23	2.0			474	
71	24					
72	25					
73	26		340	218	438	
74	27	tr.	498	258	594	156
75	28	34.6			405	330
76	29	1.0	353	208	411	123
77	30	tr.	398	196		
78*	31		360	300	816	132
79*	Aug. 1	7.2				
80*	2	1.8				
81	3		318	240	285	21
82	4		485	310	373.5	117
83	5	tr.				
84	6	1.8				
85*	7	1.2				
86*	8	4.6				
87	9		317	220	111	48
88	10		347	283	504	69
89	11		301	236	255	309
90	12	.2	338	190	156	123

Table 2. Cont'd.

Day	Date	Amount of rain (mm)	Effort (angler - hours) East Lockport	West Lockport	Selkirk	Netley
91	Aug. 13					
92*	14	11.4	529	311	465	315
93*	15	.4	635	313	1107	384
94	16					
95	17		362	259	189	162
96	18	16.8	392	193	204	147
97	19	tr.	327	141		222
98	20				264	111
99*	21	2.4				
100*	22	9.2				
101	23		529	249.5	336	168
102	24	tr.	328	176	330	192
103	25	.6	305	157	316.5	99
104	26	tr.	353	166	156	78
105	27					
106*	28	1.4				
107*	29					
108	30					
109	31	tr.				
110	Sept. 1	7		322	198	
111	2			256	306	
112	3					
113*	4					
114*	5	tr.				
115	6	4				
116	7	0.2		275	315	
117	8			339.5	387	135
118	9				369	99
119	10					
120*	11	tr.	724		423	234
121*	12				3150	
122	13					
123	14			219		
124	15			363	639	63
125	16	tr.		349	657	81
126	17	tr.			450	36
127*	18	4.7				
128*	19	0.2				
129	20			240	369	
130	21			377	495	99
131	22	3.0		409	378	72
132	23	1.0				
133	24					
134*	25	tr.		451	2313	720
135*	26				2286	
136	27	22.6				

Table 2. Cont'd.

Day	Date	Amount of rain (mm)	Effort (angler - hours)			
			East Lockport	West Lockport	Selkirk	Netley
137	Sept. 28	15.5	54.5			
138	29			381	165	9
139	30				531	9
140	Oct. 1	4.2				
141*	2	.4				
142*	3	2.2				
143	4	.8		639	801	
144	5	tr.		228	540	36
145	6	16.8		252	882	
146	7	2.4				
147	8	.2				
148*	9	4.8		744	2268	
149*	10	22.0				
150	11	3.0				
151	12	tr.				
152	13					
153	14					
154	15				882	54
155*	16	2.4			2628	153
156*	17	0.4				
157	18	tr.				
158	19					
159	20					
160	21					
161	22					
162*	23		477		1215	81
163*	24					
164	25					
165	26					
166	27	tr.				
167	28	1.2				
168	29	0.6				
169*	30					

* weekend days or holidays

Table 3. Descriptive statistics of observed daily angling effort.

Daily effort and type	Mean effort (angler hours)	Standard deviation	N	Effort (angler hours) Minimum	Maximum
effort per station	428.5	446.2	296	9	3150
Sunny days					
east Lockport	441.9	148.8	28	214	813
east Lockport	320.0	128.3	34	191	699
Selkirk	791.5	757.2	41	111	3150
Netley	205.9	177.5	36	9	723
Rainy days					
east Lockport	403.6	208.8	31	36	1043
west Lockport	300.3	162.2	40	39	820
Selkirk	643.0	609.2	48	60	2628
Netley	220.9	206.0	38	15	1152
Sunny and rainy days					
east Lockport	421.8	182.3	59	36	1043
west Lockport	310.1	147.8	74	39	820
Selkirk	712.9	680.7	89	60	3150
Netley	211.6	191.0	74	9	1152

stations and differences in effort due to the interaction of stations and day type (Saturday versus Sunday) were significant (F= 18.23, d.f.= 2 and 20; F= 4.93, d.f.= 1 and 20, respectively)(Appendix C).

Spatial and temporal changes in species-specific estimates of mean daily total weights removed from the Red River (Figs. 5-18) were generally characterized by the following traits:

a. Catches of saugers, walleyes and burbot generally increased in the fall (Figs. 5-7). Summer catches of saugers at East Lockport were an exception (Fig. 5).

b. Walleye and sauger catches tended to increase upstream (Figs. 5, 6).

c. Catches of goldeyes, mooneyes, white bass, rock bass, freshwater drum and suckers (Figs. 8-13) were higher in the spring and summer than in the fall.

d. Summer catches of goldeyes at east Lockport were five times larger than at other locations (Fig. 8). Mooneyes were angled exclusively at east Lockport.

e. June catches of white bass were relatively high and decreased upstream (Fig. 10).

f. Rock bass were not frequently angled downstream and were more abundant in spring (Fig. 11).

g. Large amounts of freshwater drum were caught in June at all locations (Fig. 12).

h. Retained catches of carp were larger in spring and summer than in autumn at all locations except

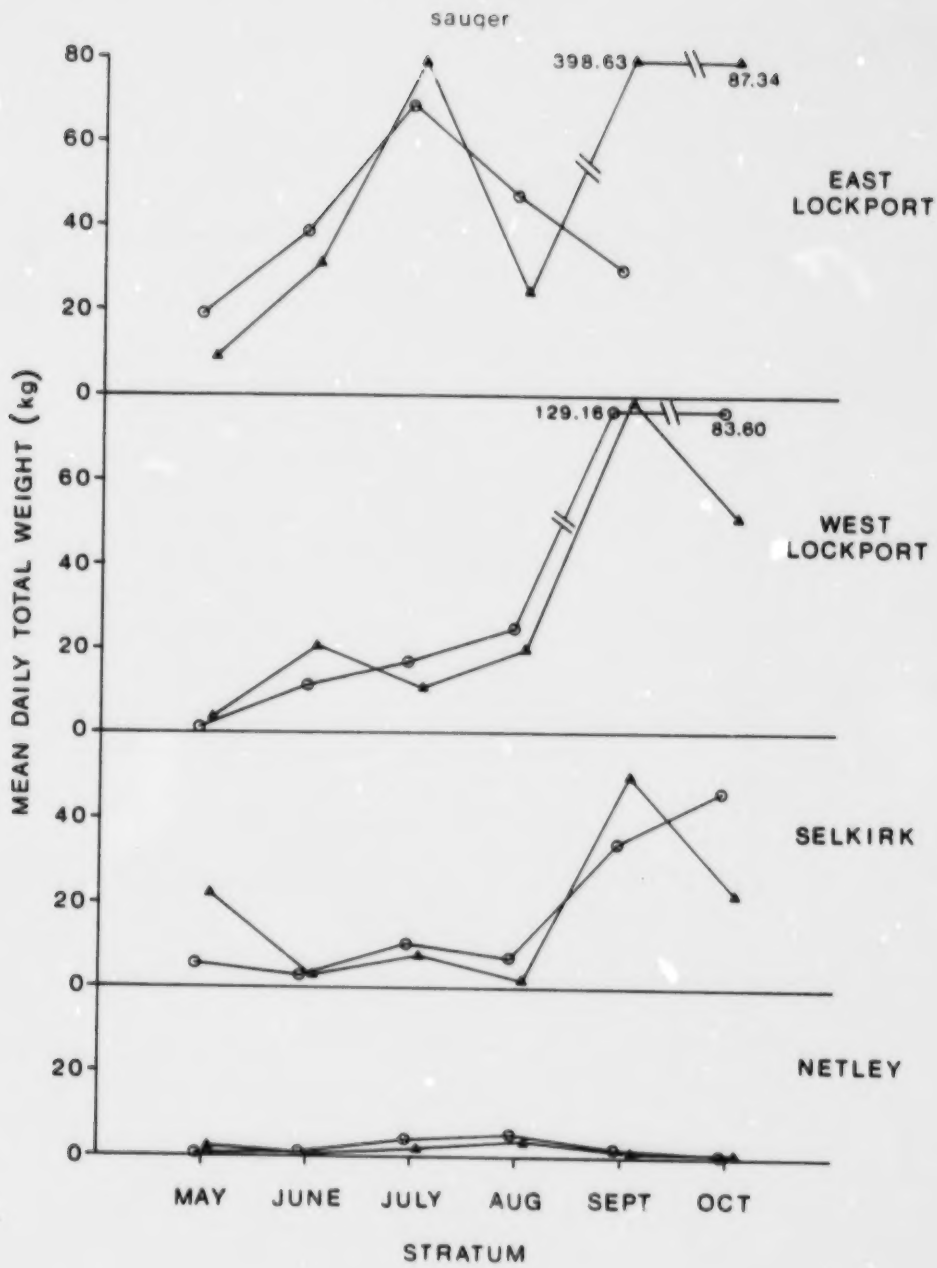


Fig. 5. Mean daily total weights of saugers removed from various locations on the Red River during the open water season. Triangles represent weekends and circles represent weekdays.

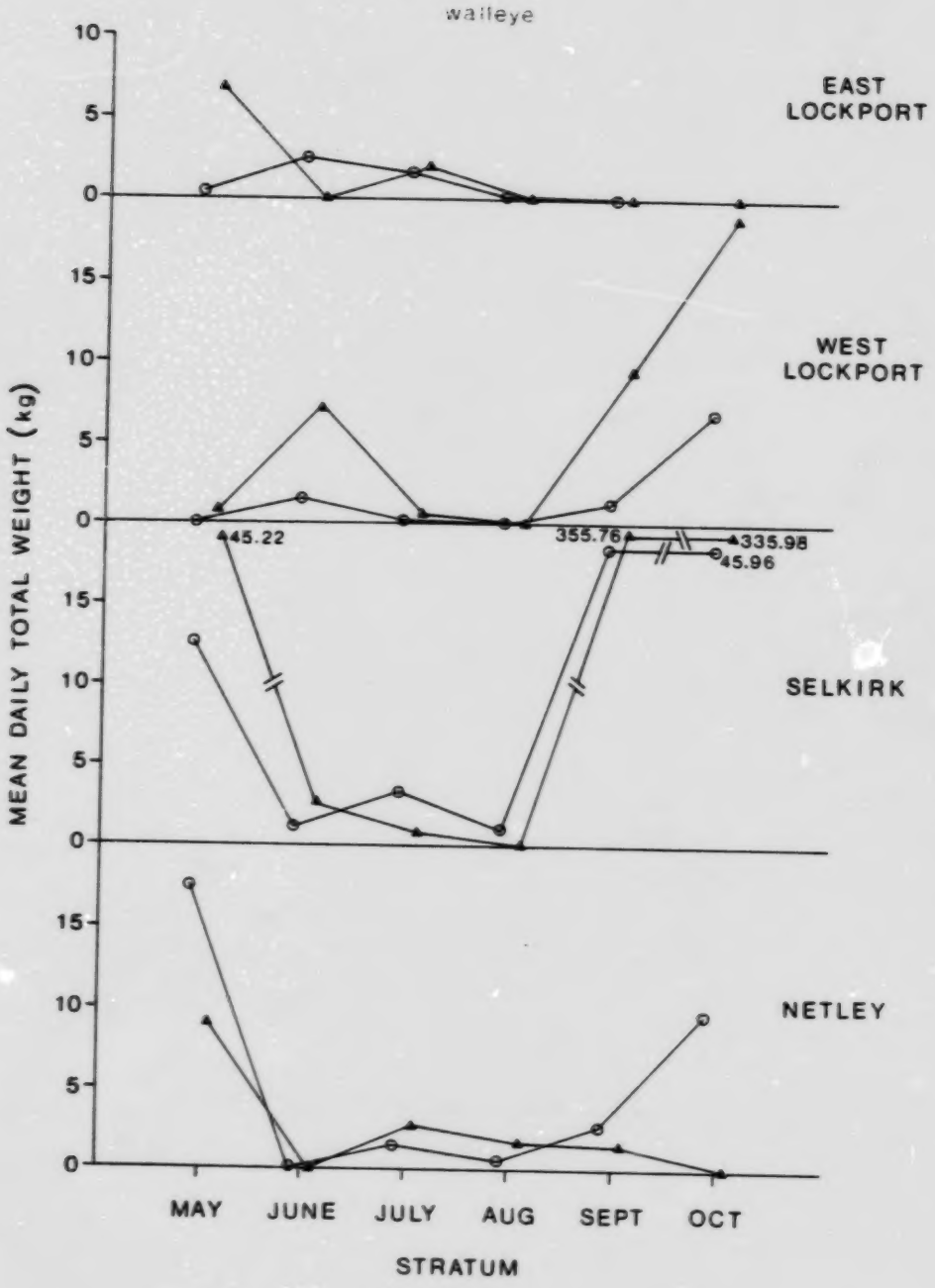


Fig. 6. Mean daily total weights of walleyes removed from various locations on the Red River during the open water season. Triangles represent weekends and circles represent weekdays.

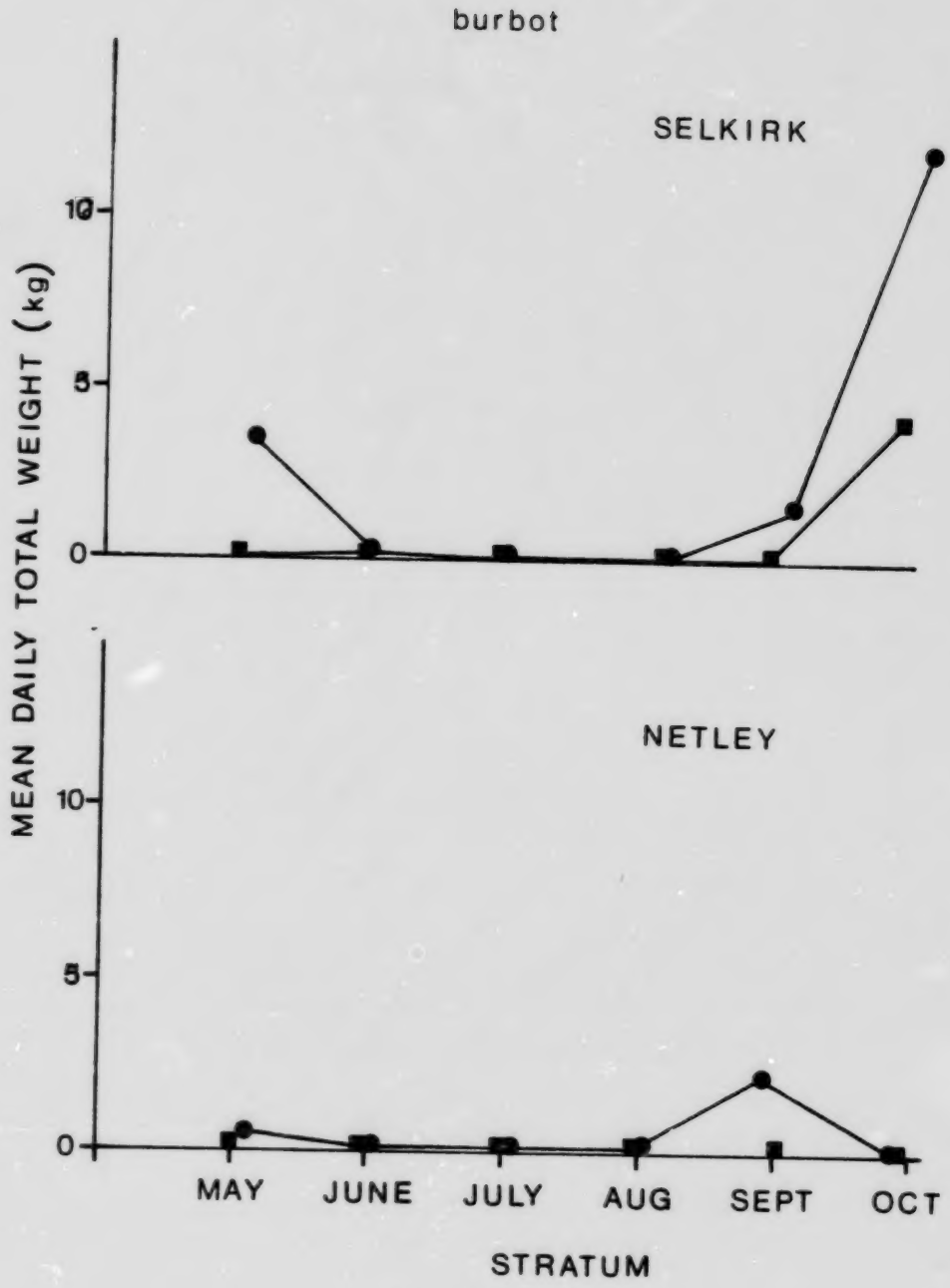


Fig. 7. Mean daily total weights of burbot removed from various locations on the Red River during the open water season. Circles represent weekends and squares represent weekdays.

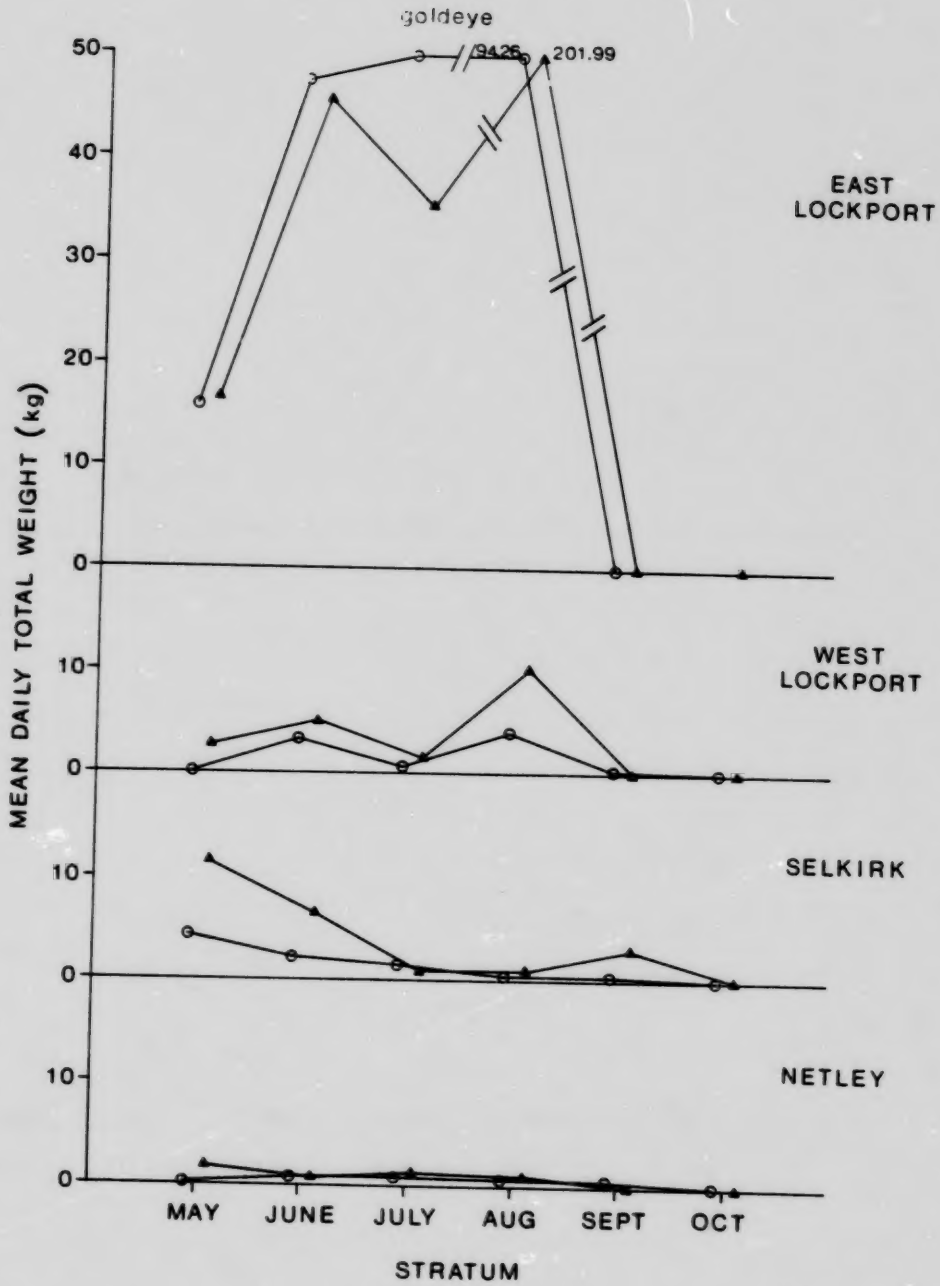


Fig. 8. Mean daily total weights of goldeye removed from various locations on the Red River during the open water season. Triangles represent weekends and circles represent weekdays.

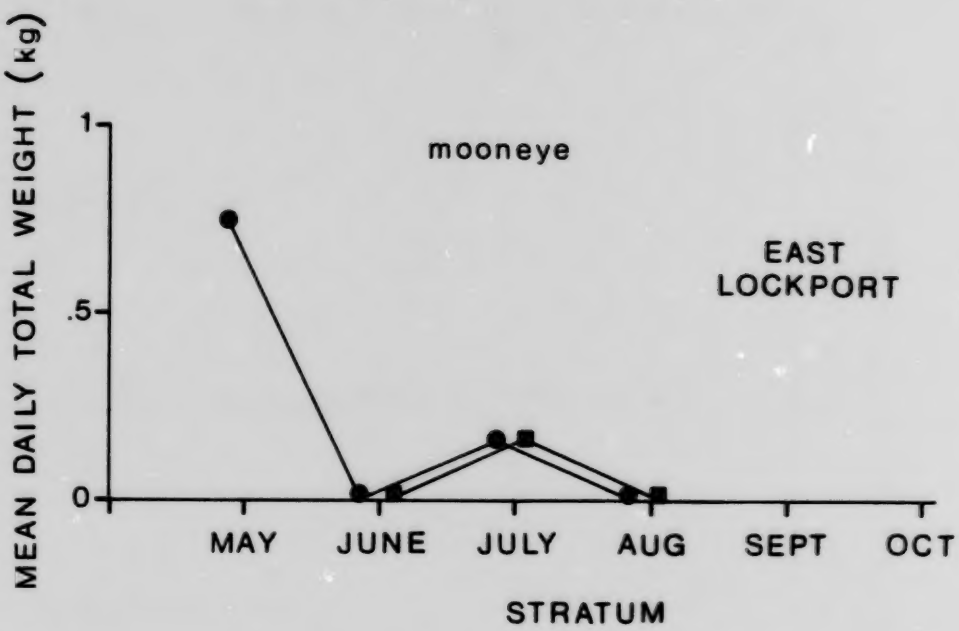


Fig. 9. Mean daily total weights of mooneyes removed from various locations on the Red River during the open water season. Circles represent weekdays and squares represent weekends.

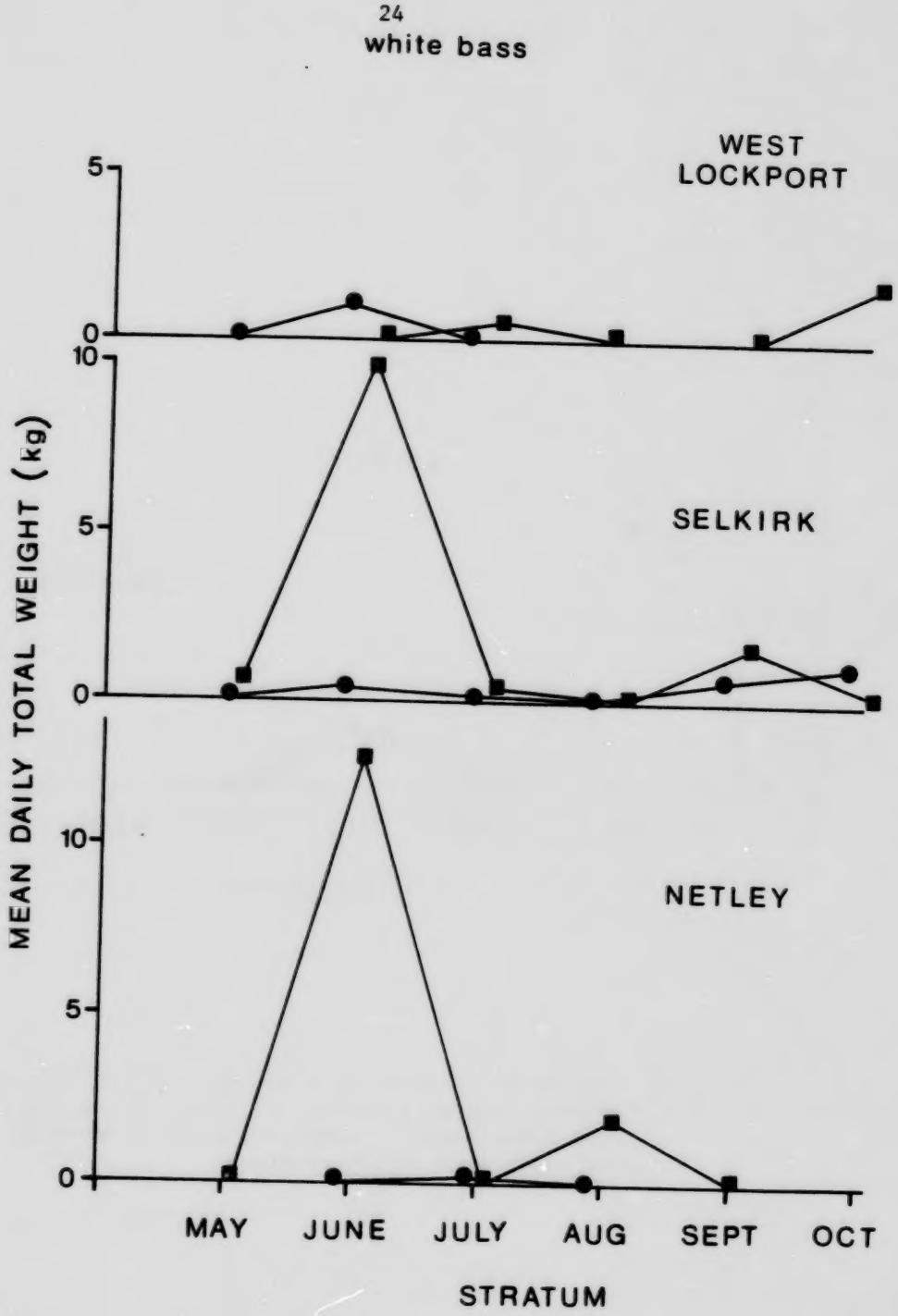


Fig. 10. Mean daily total weights of white bass removed from various locations on the Red River during the open water season. Circles represent weekdays and squares represent weekends.

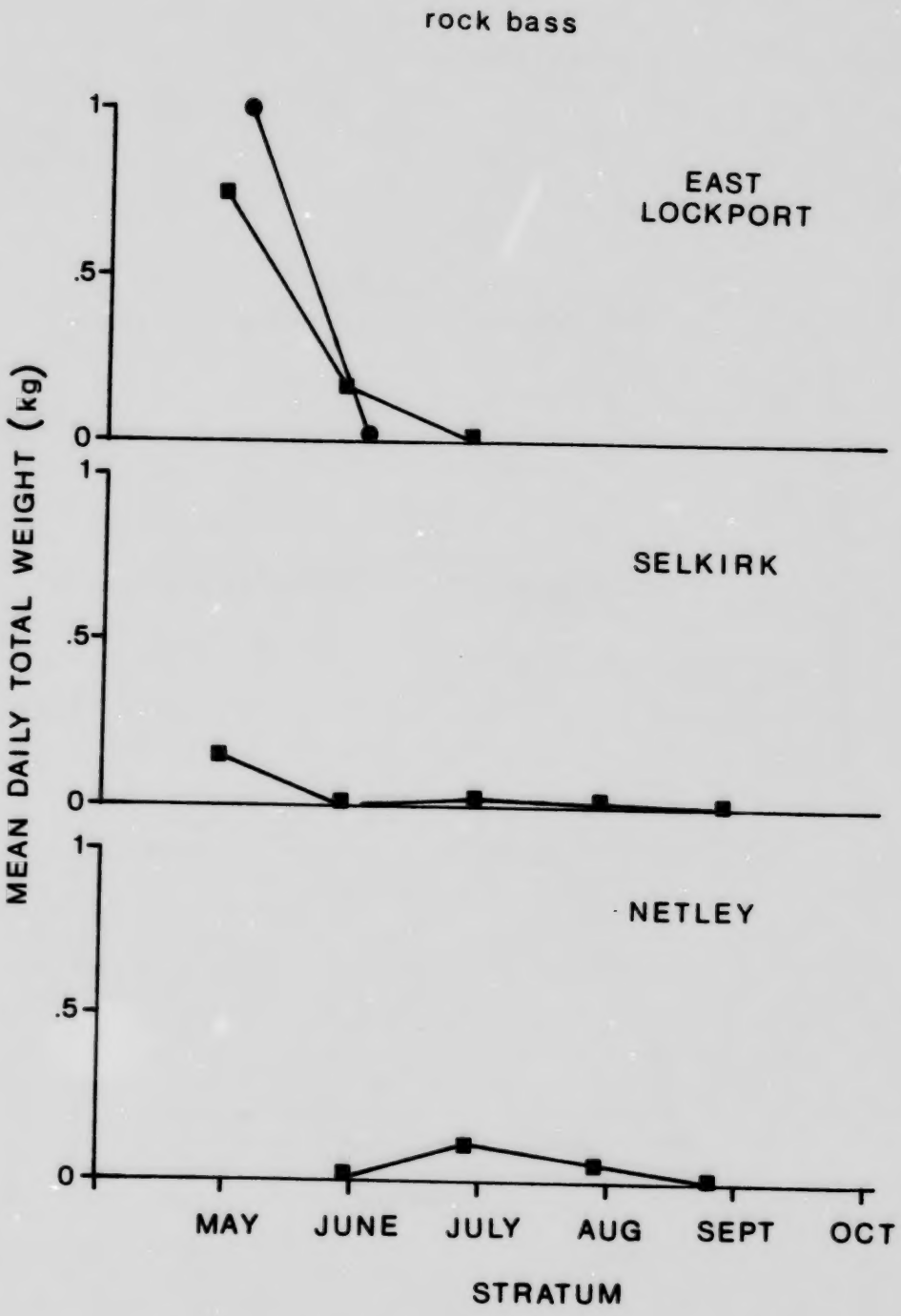


Fig. 11. Mean daily total weights of rock bass removed from various locations on the Red River during the open water season. Squares represent weekdays and circles represent weekends.

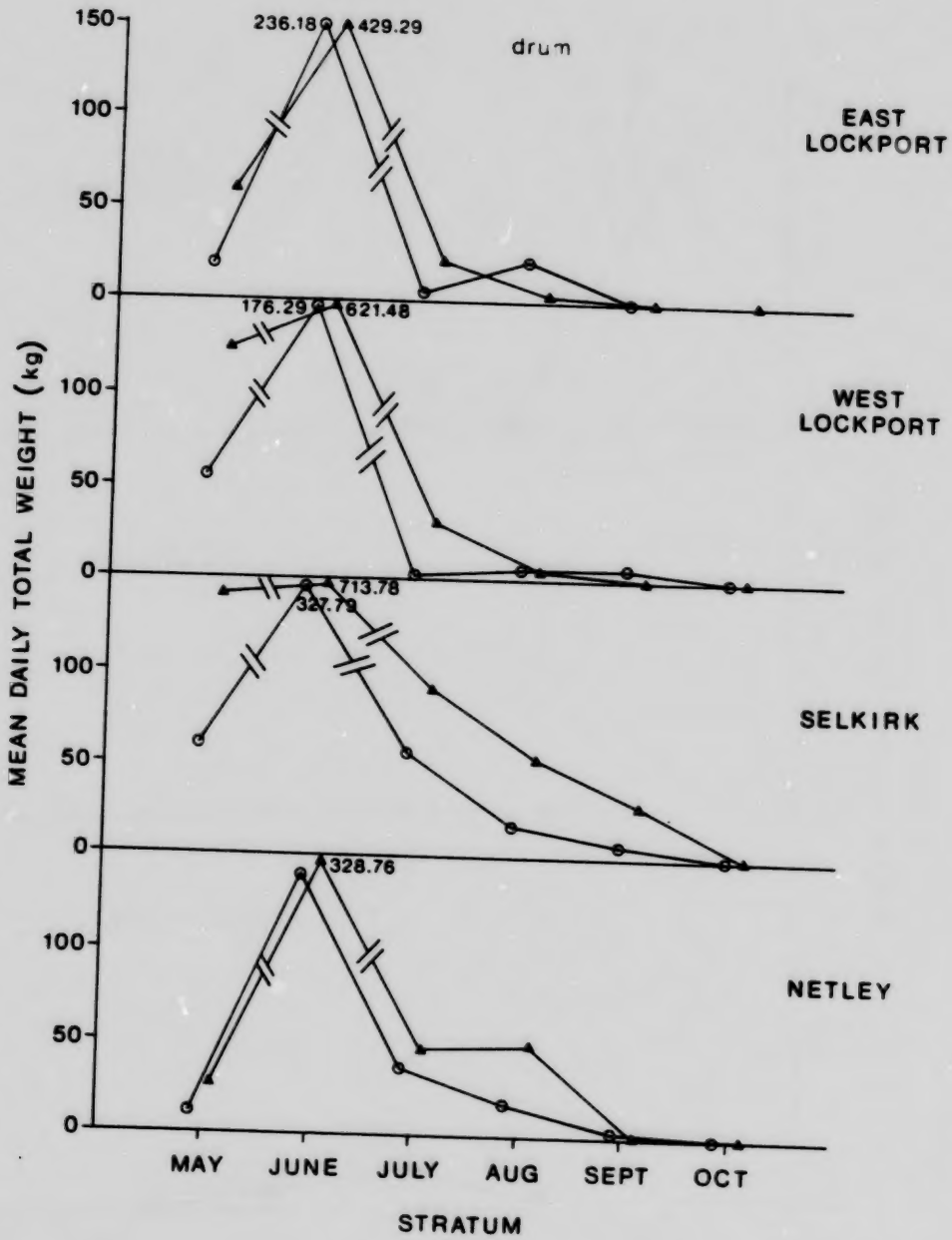


Fig. 12. Mean daily total weights of freshwater drum removed from various locations on the Red River during the open water season. Triangles represent weekends and circles represent weekdays.

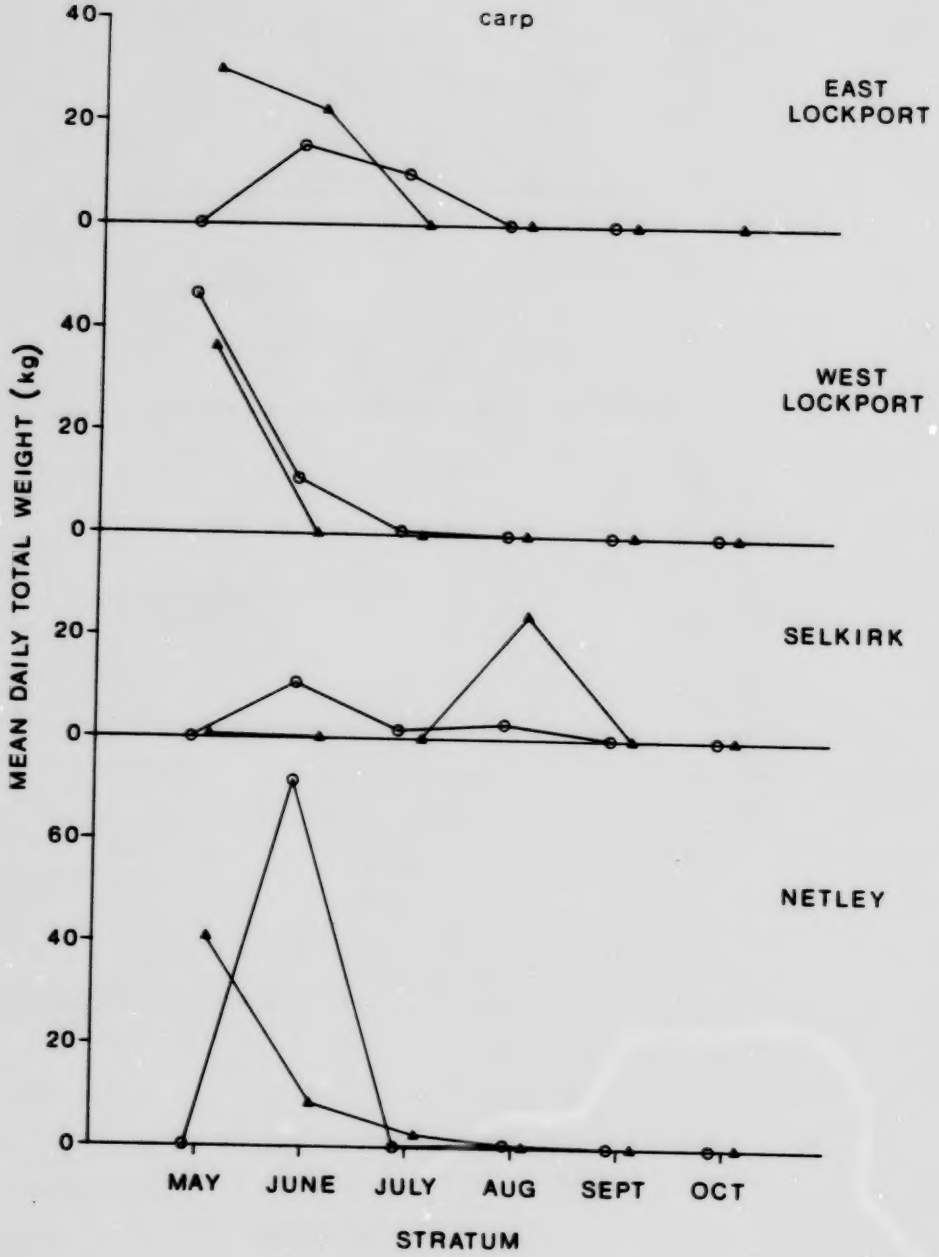


Fig. 13. Mean daily total weights of carp removed from various locations on the Red River during the open water season. Triangles represent weekends and circles represent weekdays.

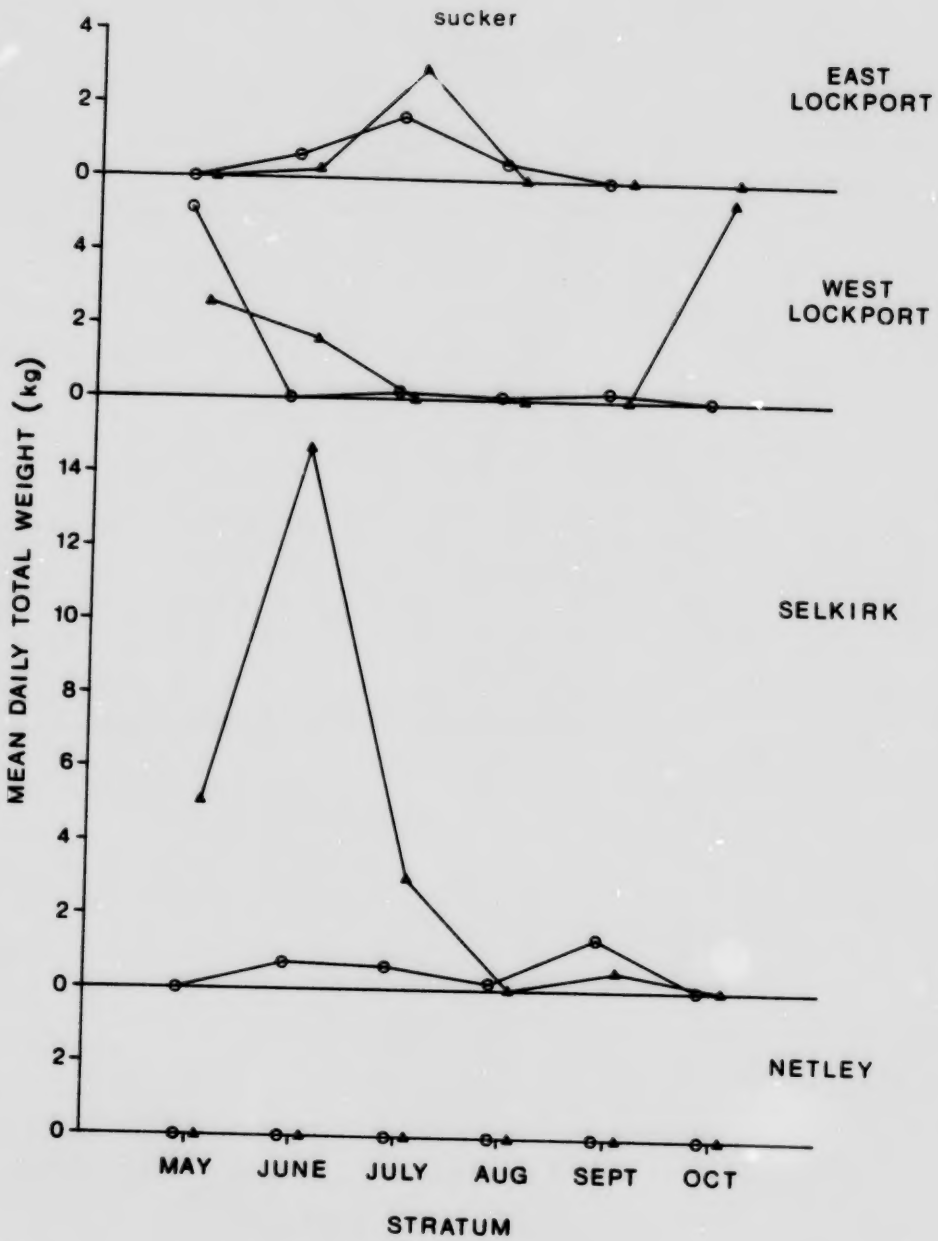


Fig. 14. Mean daily total weights of suckers removed from various locations on the Red River during the open water season. Triangles represent weekends and circles represent weekdays.

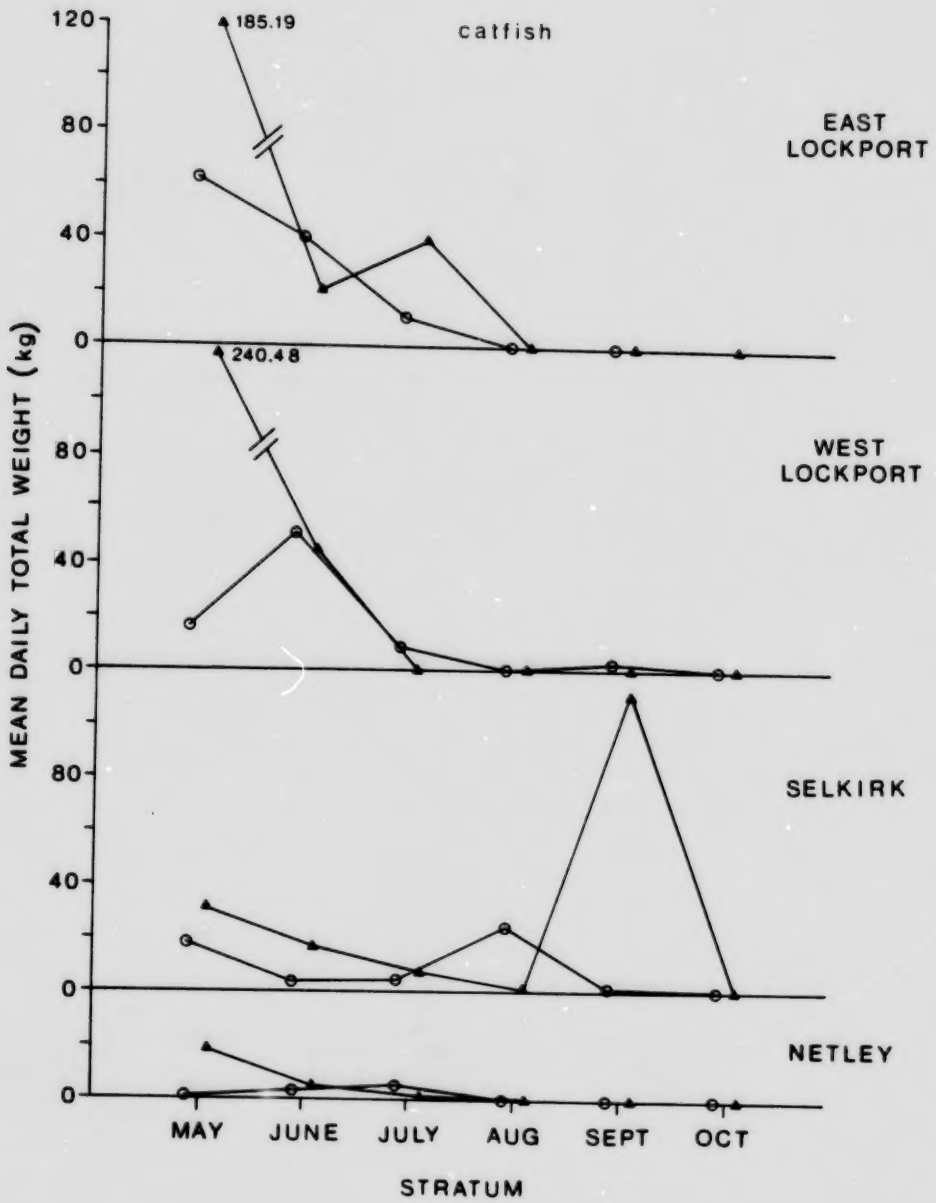


Fig. 15. Mean daily total weights of channel catfish removed from various locations on the Red River during the open water season. Triangles represent weekends and circles represent weekdays.

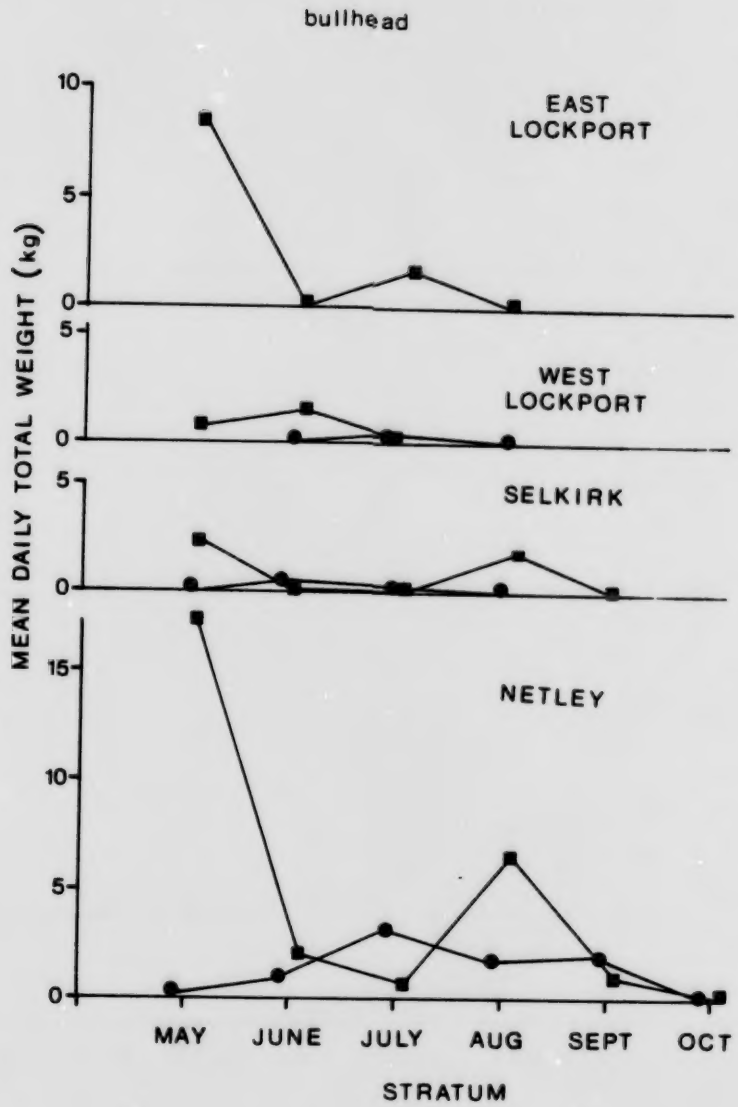


Fig. 16. Mean daily total weights of bullheads removed from various locations on the Red River during the open water season. Squares represent weekends and circles represent weekdays.

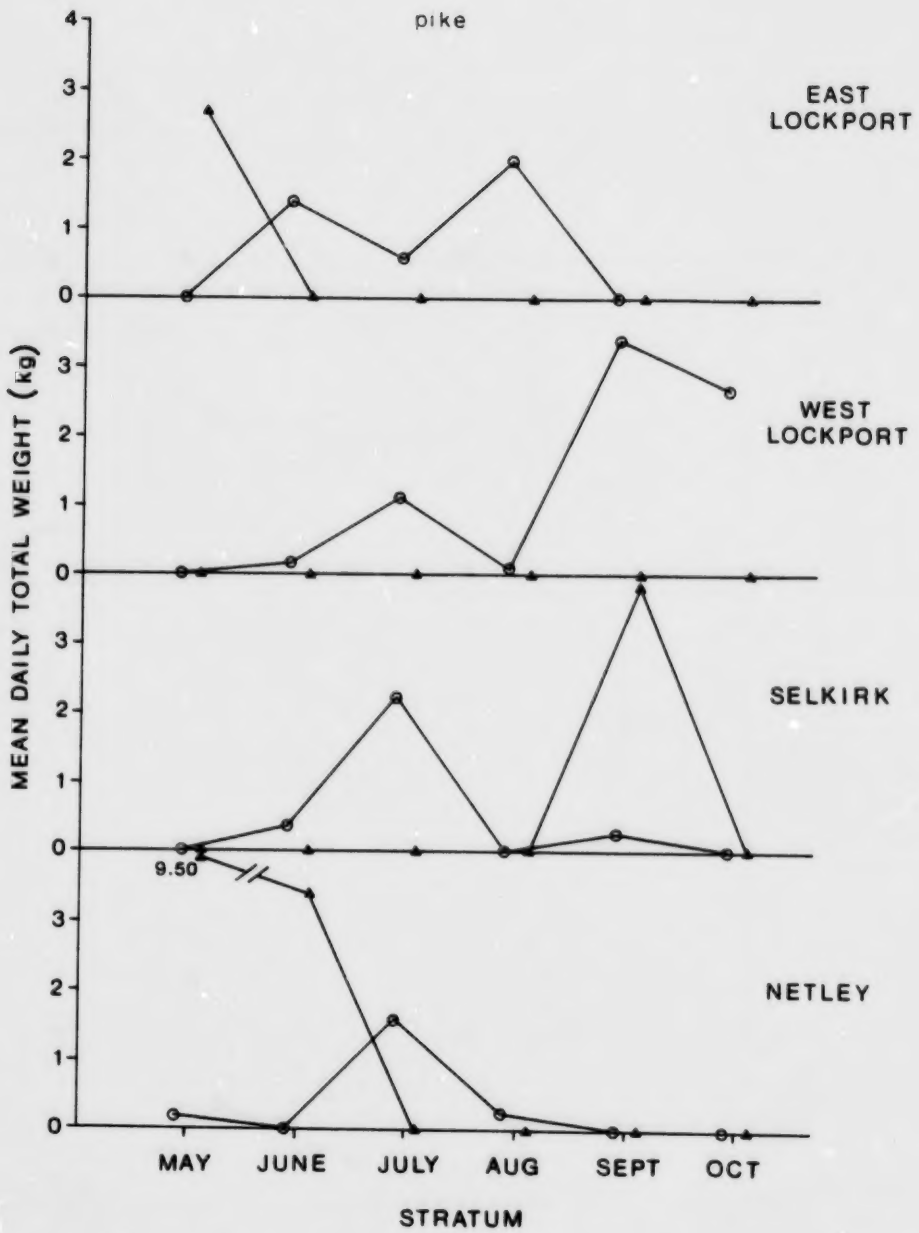


Fig. 17. Mean daily total weights of pike removed from various locations on the Red River during the open water season. Triangles represent weekends and circles represent weekdays.

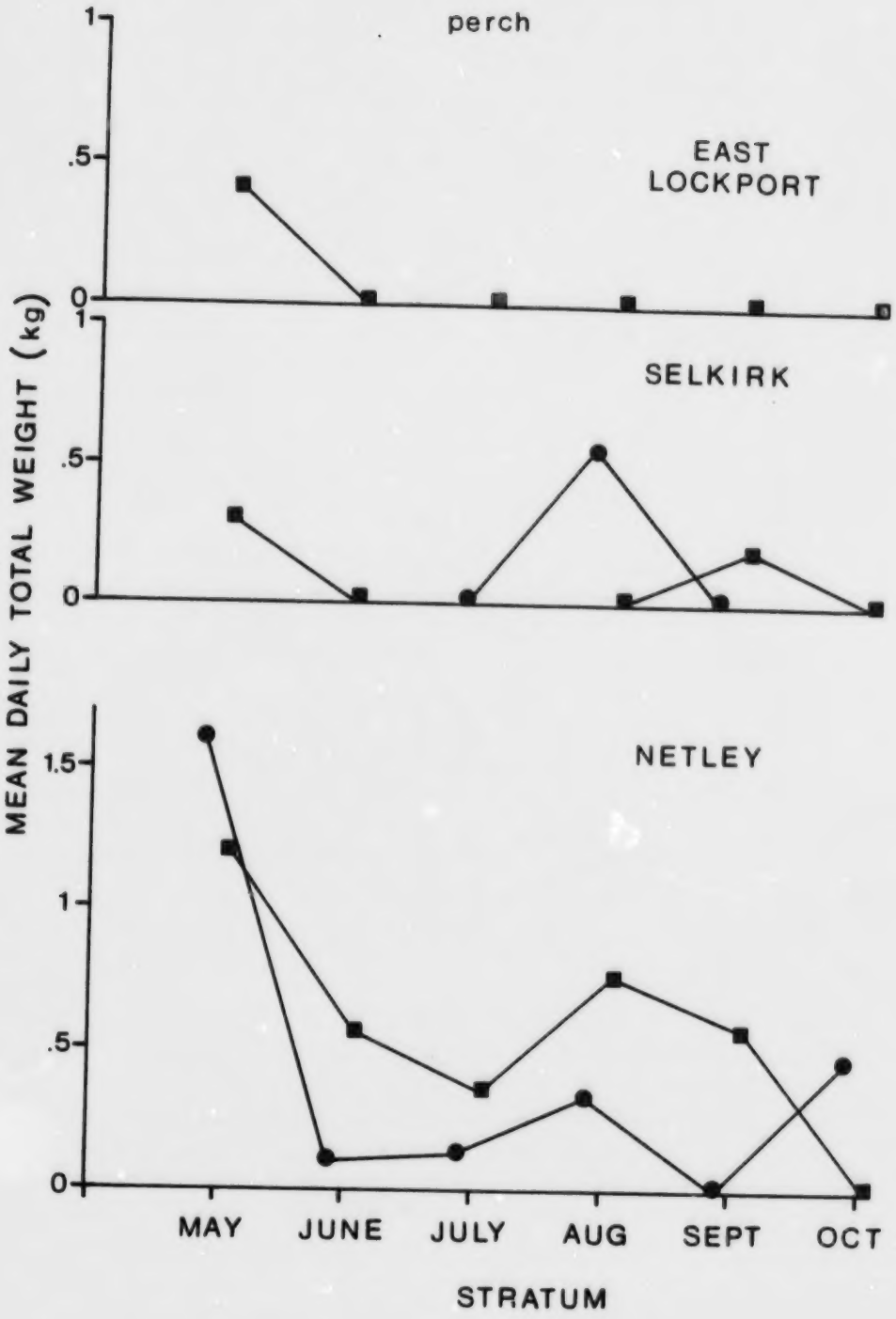


Fig. 18. Mean daily total weights of yellow perch removed from various locations on the Red River during the open water season. Circles represent weekdays and squares represent weekends.

Selkirk where carp catches were relatively low during the entire open water season (Fig. 13).

i. White sucker catches at Selkirk peaked in June and were relatively low or non-existent at other locations (Fig. 14).

j. Catches of channel catfish and brown bullheads at Lockport were higher in the spring while they were generally higher in the fall at Selkirk and Netley Creek (Figs. 15, 16).

k. Catches of pike and perch were relatively low and varied erratically over time and among locations (Figs. 17, 18).

Open water catches at all four locations were dominated by freshwater drum. Saugers, goldeyes, catfish and carp also comprised major portions of catches removed from all four locations. Walleyes comprised the second largest amount of fish removed only at Selkirk (Fig. 19). Catches of species comprising minor fractions of the total catch are compared in Fig. 20.

The relative importance of each species comprising the total catch at each location changes when numerical abundances are considered instead of mass abundances (Table 4).

Winter survey

One observation in mid December, 1982 revealed no anglers fishing on the Red River. Anglers began erecting their ice fishing shelters in late December and angling effort increased slowly in January,

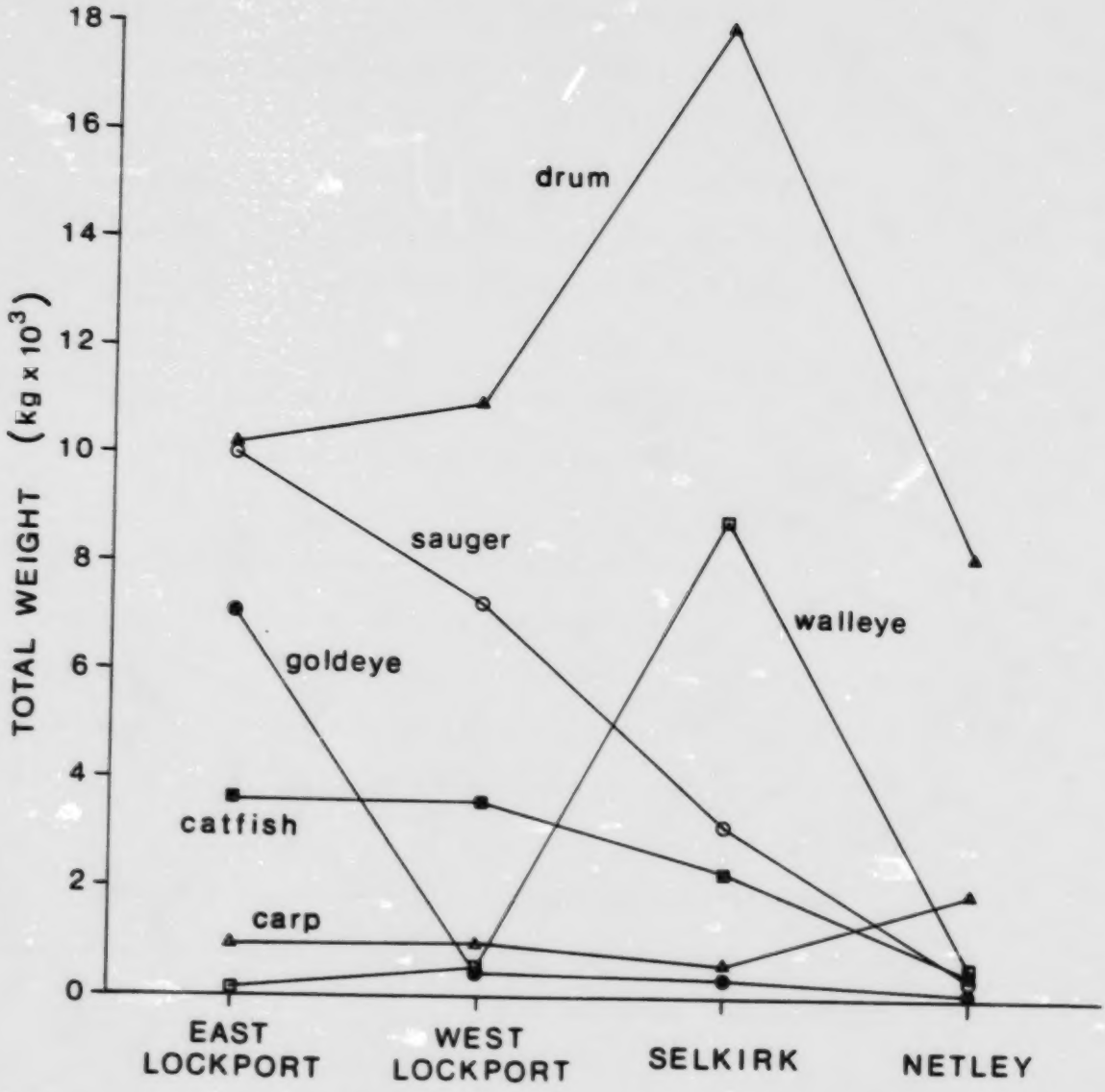


Fig. 19. Stratified random estimates of species-specific total weights removed from four locations on the Red River during the open water season.

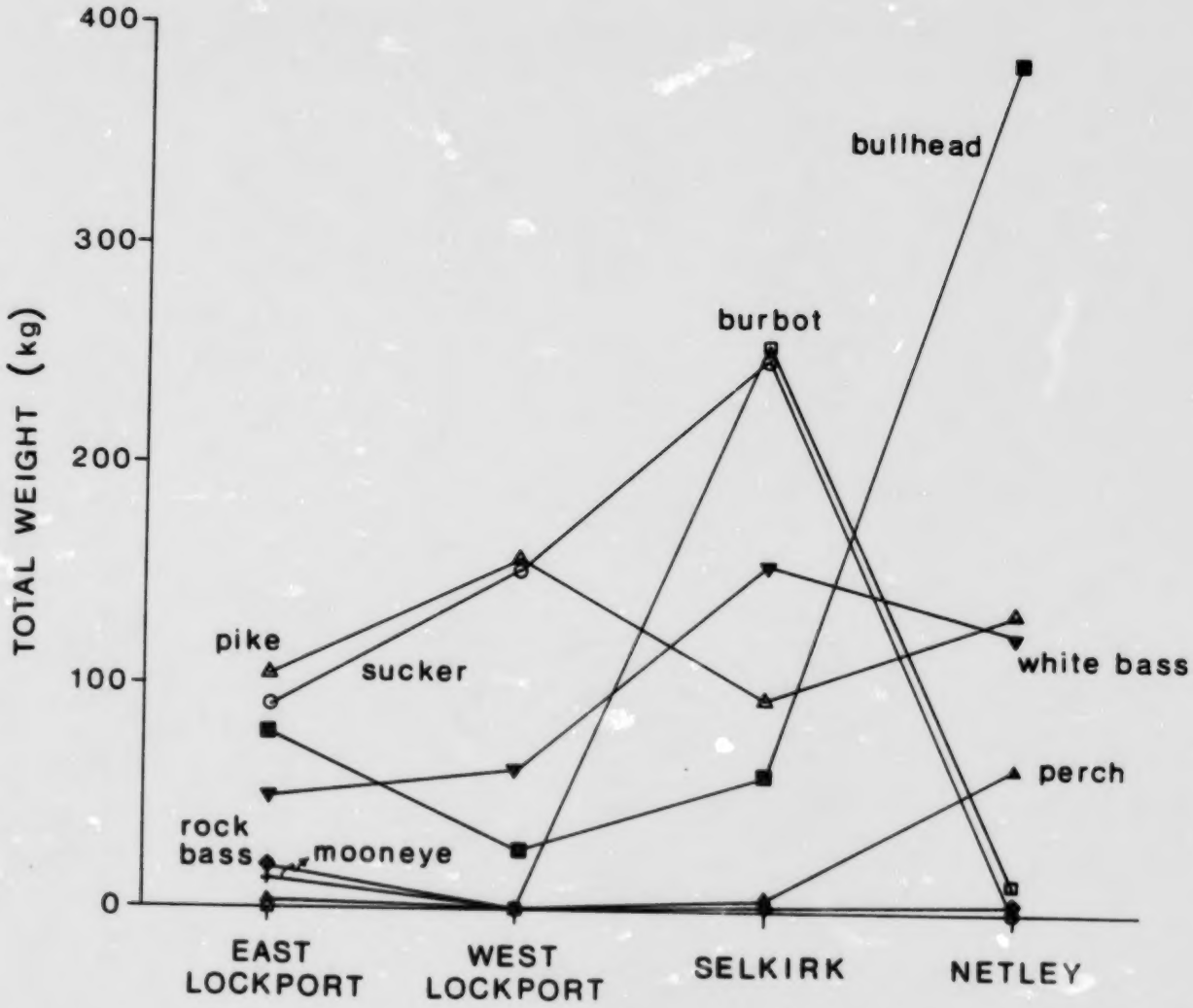


Fig. 20. Stratified random estimates of species-specific total weights removed from four locations on the Red River during the open water season.

Table 4. Stratified random estimates of total effort and total numbers and weights of fish species removed from the Red River from May 15 - October 30, 1982.

Location	Species	Number of fish		Weight of fish	
		Total number	95% C.I.*	Total weight (kg)	95% C.I.*
East Lockport	walleye	328.33	10.73	158.14	4.93
	sauger	44577.40	357.46	10008.72	69.59
	drum	11207.75	275.74	10185.47	248.62
	goldeye	35863.96	1648.97	7088.97	277.40
	pike	112.59	4.73	104.63	5.24
	sucker	154.28	9.47	91.42	5.56
	catfish	565.22	16.61	3609.11	107.52
	bullhead	264.11	11.69	77.57	3.54
	burbot	0	0	0	0
	rock bass	69.84	16.49	17.99	5.57
	carp	192.99	5.68	937.23	28.64
	mooneye	88.34	10.52	12.65	6.13
	white bass	101.21	6.36	50.41	2.53
	perch	17.16	1.33	2.89	0.23
Mean daily effort = 388.12 angler hours Total effort = 58218.54 angler hours Variance of total effort = 19744.80 95% C.I.* = ± 314.25 angler hours					
West Lockport	walleye	619.71	52.60	560.97	83.00
	sauger	32514.64	593.12	7256.07	170.32
	drum	11643.35	160.97	10967.03	135.63
	goldeye	2108.60	152.97	439.91	33.17
	pike	131.33	11.52	158.27	14.27
	sucker	135.89	17.66	152.75	20.96
	catfish	536.56	19.46	3577.53	126.15
	bullhead	88.20	4.74	25.58	1.18
	burbot	0	0	0	0
	rock bass	0	0	0	0
	carp	226.27	12.99	978.05	64.27
	mooneye	0	0	0	0
	white bass	288.83	132.49	62.82	11.40
	perch	0	0	0	0
Mean daily effort = 333.34 angler hours Total effort = 56667.99 angler hours Variance of total effort = 53282.06 95% C.I.* = ± 656.58 angler hours					
Selkirk	walleye	6374.98	394.15	8794.00	906.14
	sauger	15132.40	284.44	3149.01	57.66
	drum	19762.01	330.78	17997.82	365.14
	goldeye	1837.99	25.67	327.40	4.50

Table 4. Cont'd.

Location	Species	Number of fish		Weight of fish	
		Total number	95% C.I.*	Total weight (kg)	95% C.I.*
	pike	55.36	2.51	95.20	4.31
	sucker	416.10	14.02	250.01	12.12
	catfish	387.22	20.98	2299.17	151.16
	bullhead	181.82	7.74	61.36	11.55
	burbot	240.79	23.61	255.33	29.85
	rock bass	17.64	1.18	2.33	0.23
	carp	183.72	71.76	578.27	192.36
	mooneye	0	0	0	0
	white bass	474.99	23.89	156.14	6.72
	perch	40.64	2.24	5.04	0.30
Mean daily effort = 801.67 angler hours Total effort = 136284.30 angler hours Variance of total effort = 332958.34 95% C.I.* = ± 1271.10 angler hours					
Nerley	walleye	509.89	11.44	597.25	28.87
	sauger	1808.75	39.16	348.36	7.62
	drum	8702.82	176.45	8199.44	184.61
	goldeye	545.56	10.78	95.48	1.83
	pike	59.33	4.05	134.87	7.89
	sucker	0	0	0	0
	catfish	97.06	2.89	447.84	17.47
	bullhead	896.34	24.54	385.72	10.10
	burbot	24.35	1.58	12.15	0.98
	rock bass	13.15	0.77	3.68	0.24
	carp	331.59	16.78	1946.70	128.61
	mooneye	0	0	0	0
	white bass	244.76	22.74	124.52	16.75
	perch	424.63	12.61	65.92	2.75
Mean daily effort = 204.48 angler hours Total effort = 34762.15 angler hours Variance of total effort = 42018.03 95% C.I.* = ± 622.70 angler hours					
Total of four stations	walleye	7833		10110	
	sauger	94033		20762	
	drum	51316		47348	
	goldeye	40357		7951	
	pike	358		493	
	sucker	706		494	
	catfish	1486		9934	
	bullhead	1430		551	
	burbot	265		267	

Table 4. Cont'd.

Location	Species	Number of fish		Weight of fish	
		Total number	95% C.I.	Total weight (kg)	95% C.I. *
	rock bass	101		24	
	carp	935		4440	
	mooneye	88		13	
	white bass	1089		394	
	perch	483		74	
		Σ = 200580		102855	

Total effort = 285,933 angler hours
Total catch angler^{-1} hour^{-1} = 0.3597 kg, 0.7015 fish
Total catch ha^{-1} $\simeq$ 200 fish, 103 kg.

95% C.I. = $\pm tv(\hat{T})$

1983. Maxima in total daily angling effort at Lockport, Selkirk and Netley Creek were observed in late February (Figs. 21-23). Distributions of angling durations at all locations during January and March were similar. Anglers spent about three to four hours fishing per day. Angling durations during February were more variable and longer than in January or March (Figs. 24-26).

Stratified random estimates of species specific CUE and total catch values (in terms of numbers and weights of fish) and daily effort (Table 5) indicate the following general traits:

a. Saugers were not observed in anglers' catches at Netley Creek. They were scarce throughout the winter at Selkirk and were most abundant in catches at Lockport during February.

b. Walleyes were angled most frequently at Selkirk during February. Walleye catches declined at Lockport while they increased at Netley Creek during the winter season.

c. Pike dominated anglers' catches at Netley Creek thoughout winter.

d. Yellow perch were observed at Selkirk only during January. They did not occur in anglers' catches at Lockport but were most abundant and increased throughout the season at Netley Creek.

e. Suckers were observed only at Lockport during February.

f. Burbots were observed at Netley Creek during February and March.

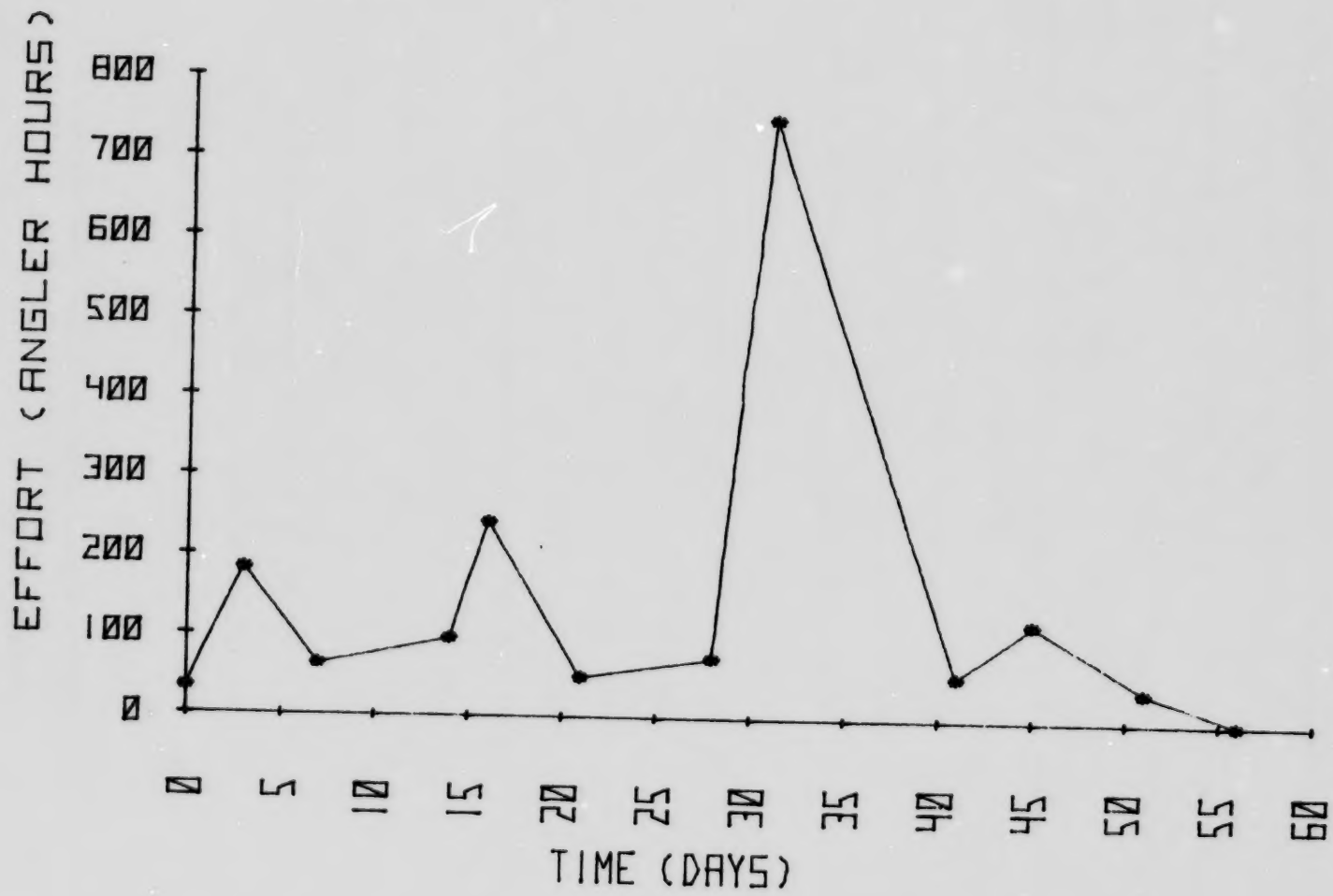


Fig. 21. Temporal distribution of daily angling effort at Lockport during the winter of 1982 - 1983.

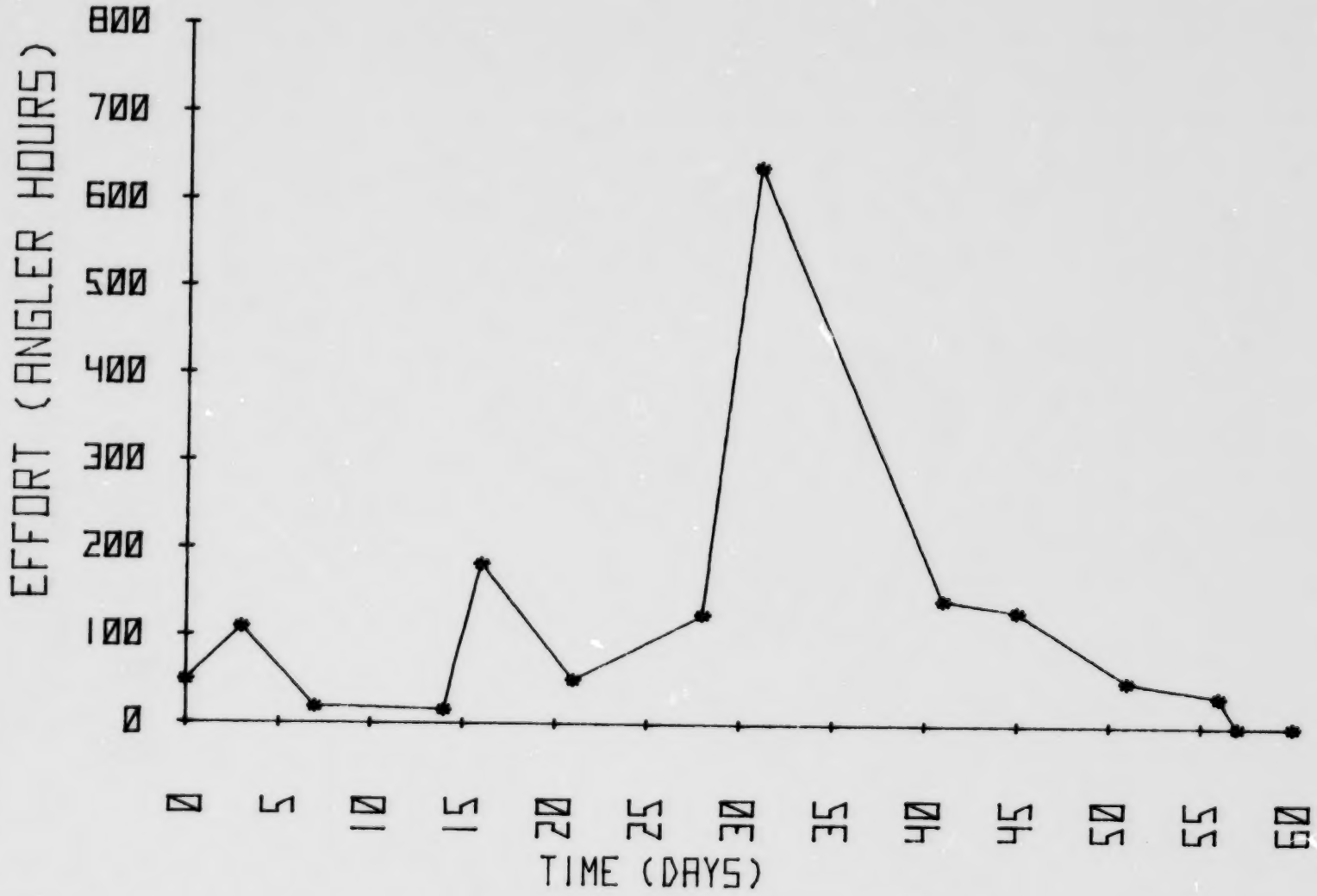


Fig. 22. Temporal distribution of daily angling effort at Selkirk during the winter of 1982 - 1983.

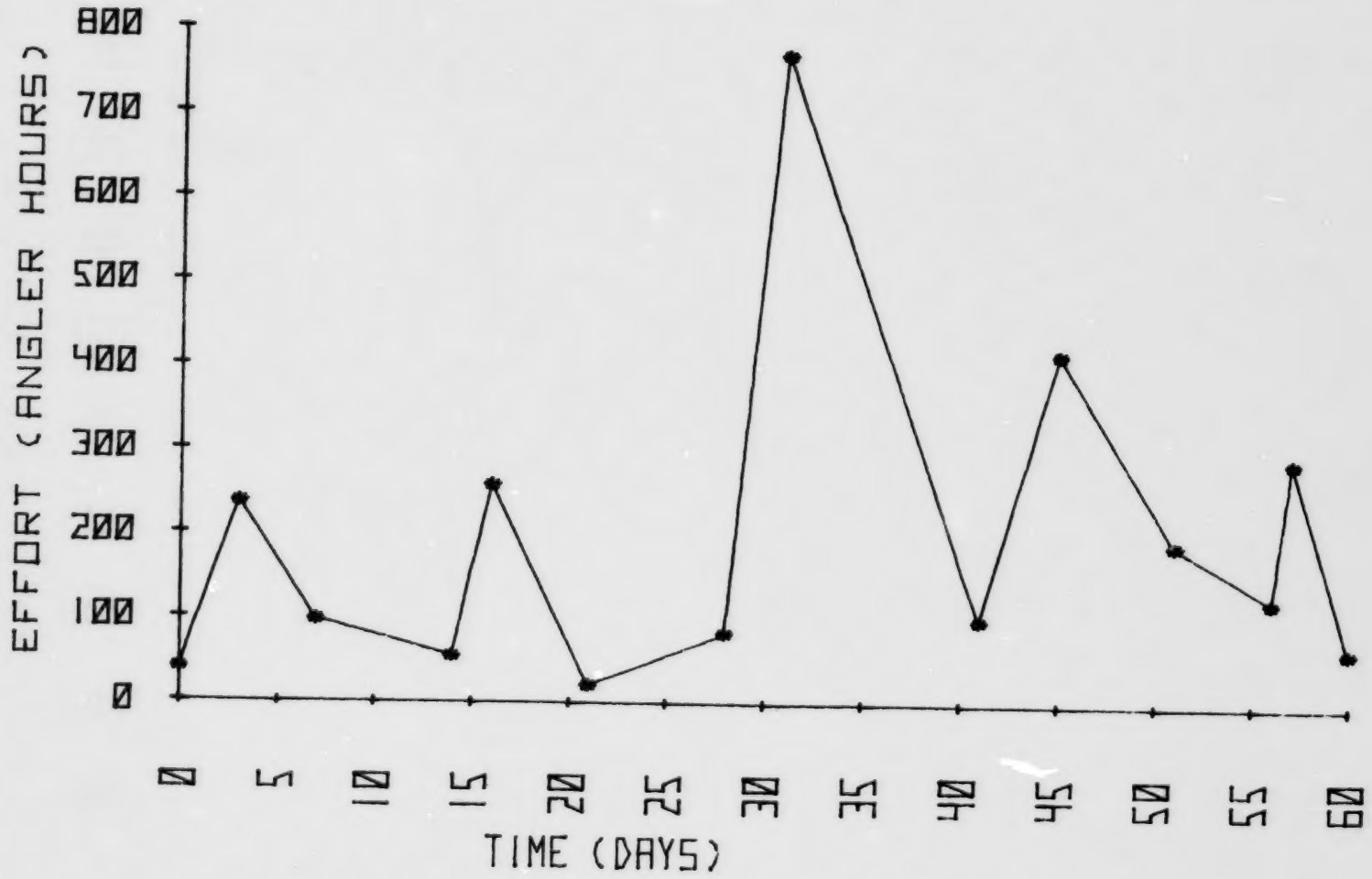


Fig. 23. Temporal distribution of daily angling effort at Netley Creek during the winter of 1982 - 1983.

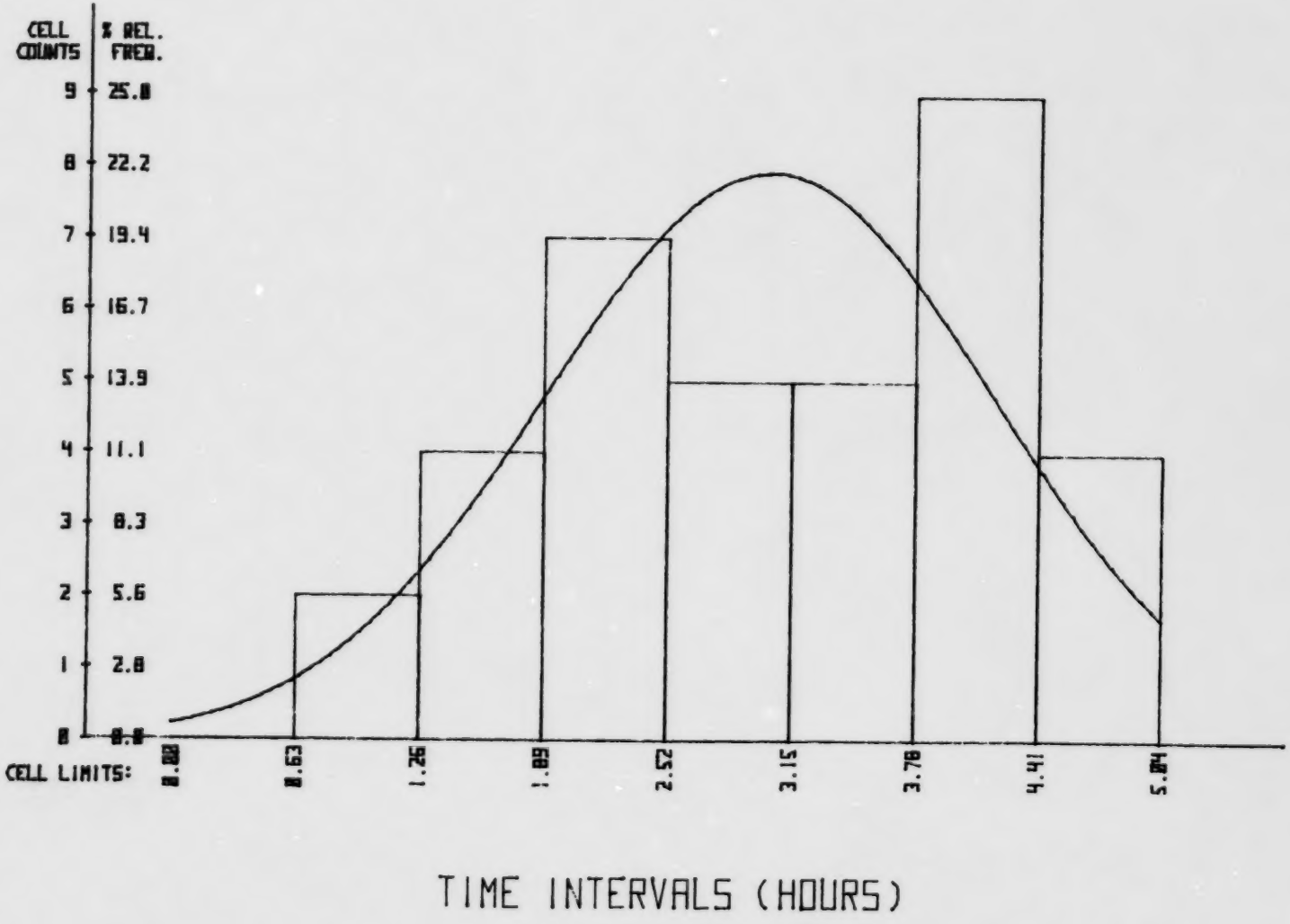


Fig. 24. Distribution of angling duration on the Red River during January, 1983. Cell limits represent hours.

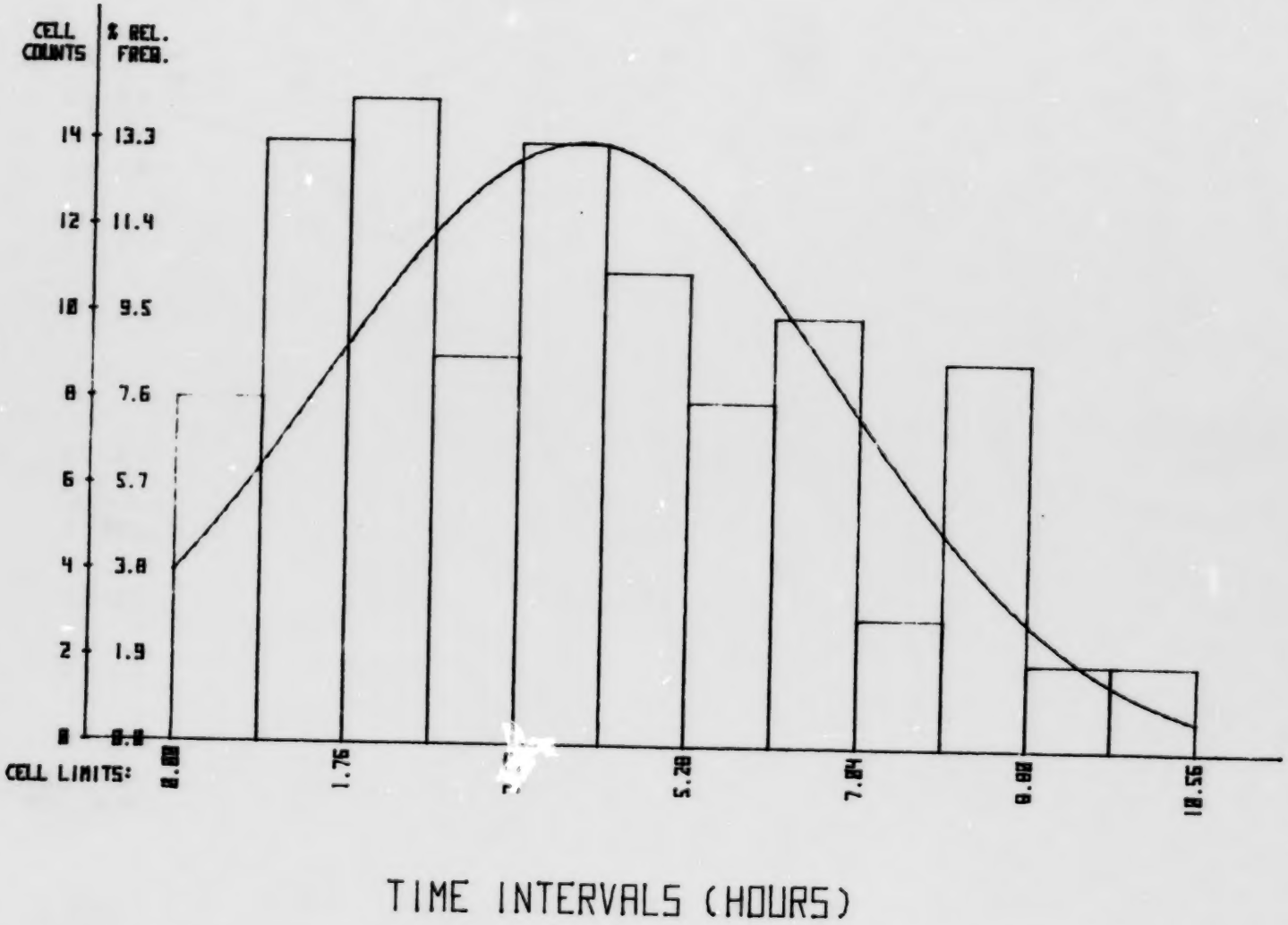


Fig. 25. Distribution of angling duration on the Red River during February, 1983. Cell limits represent hours.

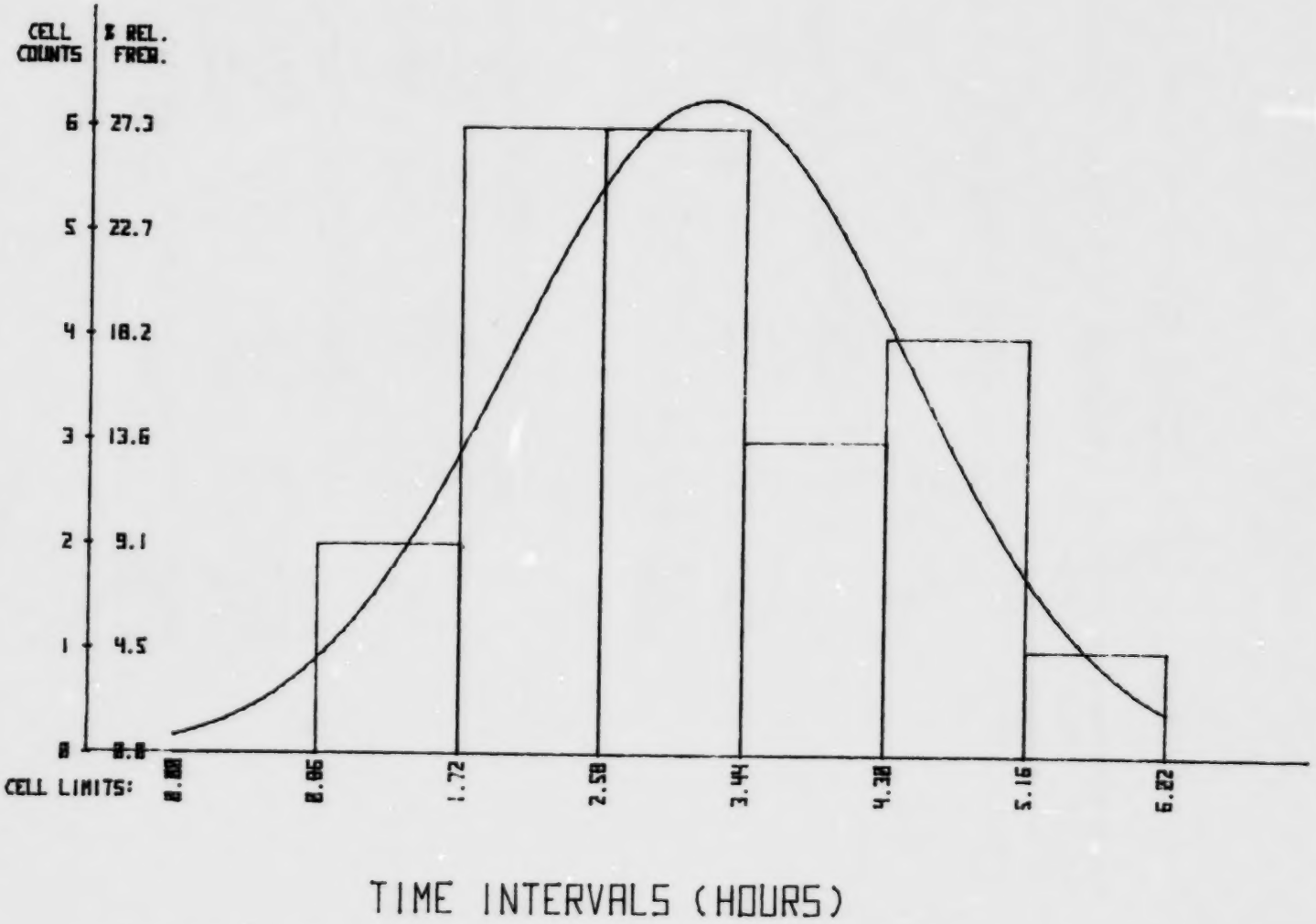


Fig. 26. Distribution of angling duration on the Red River during March, 1983. Cell limits represent hours.

Table 5. Species specific CUE values, total catches and estimates of angling effort on the Red River from January to March, 1983.

Location	Month	Species	CUE (catch angler hour^{-1}) No.	Variance	Weight (kg)	Variance
Lockport	January	walleye	0.107	0.00249	0.127	0.00319
		pike	0.015	0.00110	0.013	0.00079
		sauger	0.474	0.10374	0.110	0.00971
			Total daily catch No.	Variance	Weight (kg)	Variance
		walleye	10.281	43.504	12.270	71.859
		pike	0.367	0.672	0.312	0.486
		sauger	59.964	3559.046	13.166	200.510
		Mean daily effort (angler hours) 126.458 variance 13215.5				
		Mean angling duration (hours) 2.753 variance 0.292				
		N_h= 31 n_h= 5				
	February		CUE (catch angler hour^{-1}) No.	Variance	Weight (kg)	Variance
		walleye	0.013	0.000815	0.009	0.0003917
		pike	0.002	0.000027	0.002	0.000027
		sauger	0.365	0.02791	0.075	0.001239
		sucker	0.057	0.01633	0.076	0.02884
			Total daily catch No.	Variance	Weight (kg)	Variance
		walleye	11.368	646.205	7.88	310.638
		pike	0.29	0.421	0.29	0.421
		sauger	121.955	57135.68	23.417	2073.903
		sucker	2.6	33.8	3.455	59.699
		Mean daily effort (angler hours) 226.390 variance 111461.9				
		Mean angling duration (hours) 3.471 variance 0.172				
		N_h= 28 n_h= 5				

Table 5. Cont'd.

Location	Month	Species				
Lockport	March		CUE (catch angler hour^{-1})			
			No.	Variance	Weight (kg)	Variance
		walleye	0.174	0	0.122	0
		sauger	0.696	0	0.117	0
			Total daily catch			
			No.	Variance	Weight (kg)	Variance
		walleye	8	0	5.6	0
		sauger	32	0	5.4	0
		Mean daily effort (angler hours) 46 variance 0				
		Mean angling duration (hours) 3.833 variance 0				
		N_h= 31 n_h= 1				
			Summary			
			No.	95% C.I.	Weight (kg)	95% C.I.
		walleye	885.036	83.559	774.661	58.319
		pike	19.487	3.162	17.782	2.816
		sauger	6265.623	786.430	1231.233	148.842
		sucker	72.799	19.307	96.751	25.659
		Mean daily effort (angler hours) 129.8				
		Total effort (angler hours) 11685.13 95% C.I. $\pm$ 1220.694				
		N= 90 n= 11				
Selkirk	January		CUE (catch angler hour^{-1})			
			No.	Variance	Weight (kg)	Variance
		walleye	0.448	0.4297	0.566	0.7398
		pike	0.037	0.0041	0.04	0.0048
		sauger	0.134	0.0534	0.031	0.0028
		perch	0.066	0.0133	0.031	0.0028
			Total daily catch			
			No.	Variance	Weight (kg)	Variance
		walleye	26.666	1557.333	33.787	2677.737
		pike	0.333	0.333	0.36	0.389
		sauger	8	192	1.84	10.157
		perch	4	48	1.84	10.157
		Mean daily effort (angler hours) 41.666 variance 804.333				
		Mean angling duration (hours) 2 variance 1.75				
		N= 31 n_h = 3				

Table 5. Cont'd.

Location	Month	Species	CUE (catch angler hour^{-1})			
			No.	Variance	Weight (kg)	Variance
Selkirk	February	walleye	0.210	0.1106	0.732	1.9725
		pike	0.030	0.0034	0.027	0.0028
		sauger	0.162	0.12734	0.045	0.0099

	Total daily catch			
	No.	Variance	Weight (kg)	Variance
walleye	46.318	7647.595	85.147	24859.51
pike	2.591	12.700	2.332	10.287
sauger	6.988	157.354	1.407	5.398

Mean daily effort (angler hours) 752.508 variance 0.177
Mean angling duration (hours) 6.875 variance 107.670
N_h= 28 n_h= 5

	Summary			
	No.	95% C.I.	Weight (kg)	95% C.I.
walleye	2123.561	381.900	3431.499	650.633
pike	82.879	14.537	76.451	13.054
sauger	443.671	106.812	96.431	25.192
perch	124.0	3895.087	57.040	1791.758

Mean daily effort (angler hours) 379.015
Total effort (angler hours) 22361.89 95% C.I. ± 5458.196
N= 59 n= 8

Location	Month	Species	CUE (catch angler hour^{-1})			
			No.	Variance	Weight (kg)	Variance
Netley Creek	January	walleye	0.017	0.0015	0.012	0.0007
		pike	0.302	0.0297	0.392	0.0865
		perch	0.006	0.0002	0.001	0.000005

	Total daily catch			
	No.	Variance	Weight (kg)	Variance
walleye	4.680	109.512	3.307	54.688
pike	30.925	543.514	37.618	736.041
perch	1.56	12.168	0.281	0.394

Mean daily effort (angler hours) 108.764 variance 9182.155
Mean angling duration (hours) 2.565 variance 0.738
N_h= 31 n_h= 5

Table 5. Cont'd.

Location	Month	Species	CUE (catch angler hour^{-1}) No.	Variance	Weight (kg)	Variance
Netley Creek	February	walleye	0.018	0.0010	0.024	0.0017
		pike	0.163	0.0153	0.174	0.0214
		perch	0.008	0.0003	0.004	0.00007
		burbot	0.010	0.0004	0.015	0.0012
			Total daily catch No.	Variance	Weight (kg)	Variance
		walleye	12.059	304.246	16.787	551.632
		pike	30.303	2069.162	41.524	4597.321
		perch	10.36	536.648	4.81	115.6805
		burbot	0.333	0.555	0.533	1.422
		Mean daily effort (angler hours) 383.932 variance 307750.4				
		Mean angling duration (hours) 3.964 variance 5.077				
		N_h= 28 n_h= 5				
	March		CUE (catch angler hour^{-1}) No.	Variance	Weight (kg)	Variance
		pike	0.147	0.0167	0.185	0.0263
		perch	0.189	0.1074	0.063	0.0119
		burbot	0.016	0.0008	0.013	0.0005
			Total daily catch No.	Variance	Weight (kg)	Variance
		pike	14.625	186.047	18.388	289.800
		perch	21	1323	6.99	146.580
		burbot	0.762	1.741	0.610	1.1146
		Mean daily effort (angler hours) 81.438 variance 1003.512				
		Mean angling duration (hours) 3.181 variance 0.208				
		N_h= 3 n_h= 3				
			Summary No.	85% C.I.	Weight (kg)	Variance
		walleye	482.734	59.4428	571.563	76.7251
		pike	2260.53	155.7375	2898.845	224.7797
		perch	989.440	244.5467	360.075	75.7537
		burbot	32.952	9.2298	33.8286	6.4661
		Mean daily effort (angler hours) 184.9591				
		Total effort (angler hours) 16646.32 95% C.I. $\pm$ 1833.086				
		N= 90 n= 13				

Table 5. Cont'd.

Location	Month	Species	Winter catch estimates for all areas combined	
			No.	Weight (kg)
		walleye	3491.331	4778.723
		sauger	6709.294	1327.664
		pike	2362.896	2993.078
		perch	1113.44	417.115
		burbot	32.952	33.829
		sucker	72.799	96.751
			Σ = 13782.712	9647.160

Total effort (angler hours) = 50693.34
Total catch angler^{-1} hour^{-1} = 0.272 fish, 0.190 kg.

Body size variation and growth

Seasonal size variations of saugers, walleyes, suckers, freshwater drum, goldeye, northern pike, yellow perch, brown bullheads, carp, white bass and catfish (Figs. 27-37) were depicted irrespective of age during the open water season. Data required to plot weekly variations in mean body lengths of other species observed in anglers catches were too sporadic.

Large temporal variations in body size of most species at most locations precluded meaningful descriptions of seasonal growth except for the following cases: Lockport saugers (Fig. 27), Selkirk saugers (Fig. 27), Lockport goldeyes (Fig. 31) and Lockport catfish (Fig. 37).

Age-specific seasonal growth curves of intensively sampled species (Figs. 38-48) displayed more distinctive trends in many cases. Large spatial and temporal variations and "negative growth" characterized many of the age specific seasonal growth curves (for example, 5 and 6 year old freshwater drum (Figs. 38, 39). Growth curves of saugers displayed relatively low spatial and temporal variations and positive seasonal growth increments (Figs. 41-43). Body length data collected from Lockport goldeyes produced comprehensive seasonal growth patterns (Figs. 44-46). Body lengths of walleyes sampled at Selkirk decreased from spring to summer and increased from summer to autumn (Fig. 47). Body lengths of three year old walleyes sampled at Lockport were similar to those of Selkirk walleyes but four year old Lockport walleyes were distinctly larger than four year old Selkirk walleyes (Fig. 48).

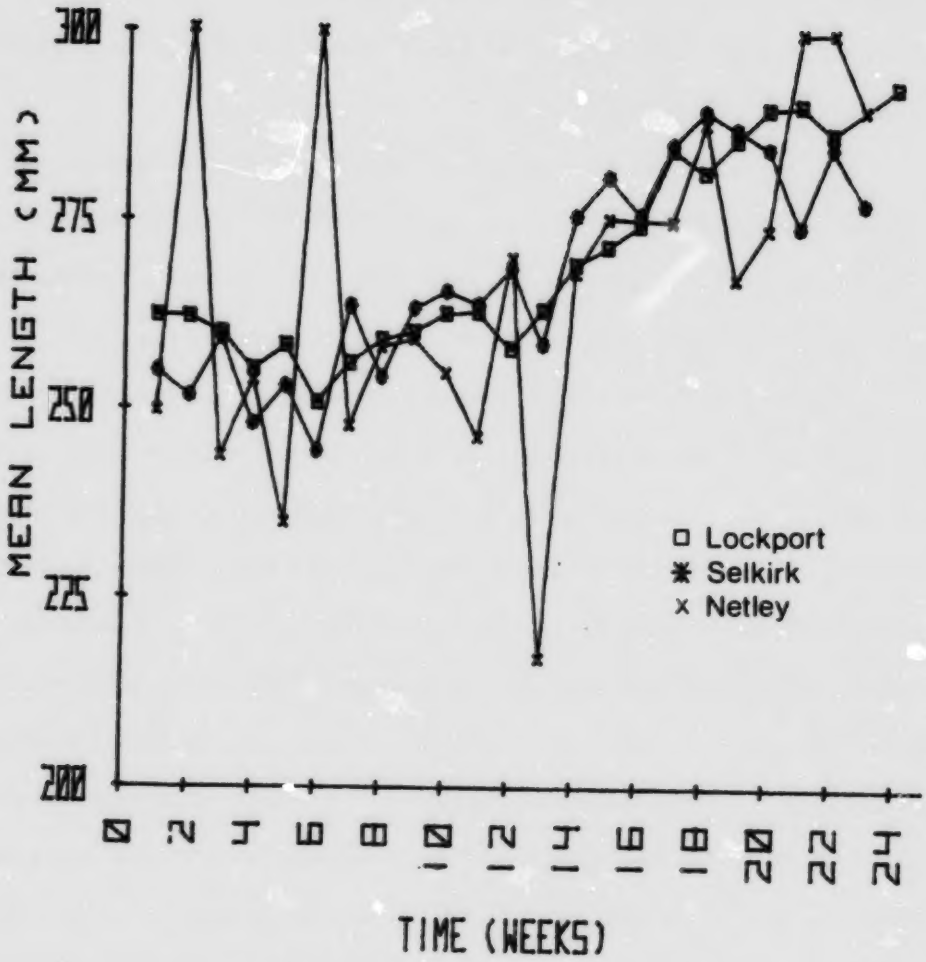


Fig. 27. Seasonal growth curves of saugers.

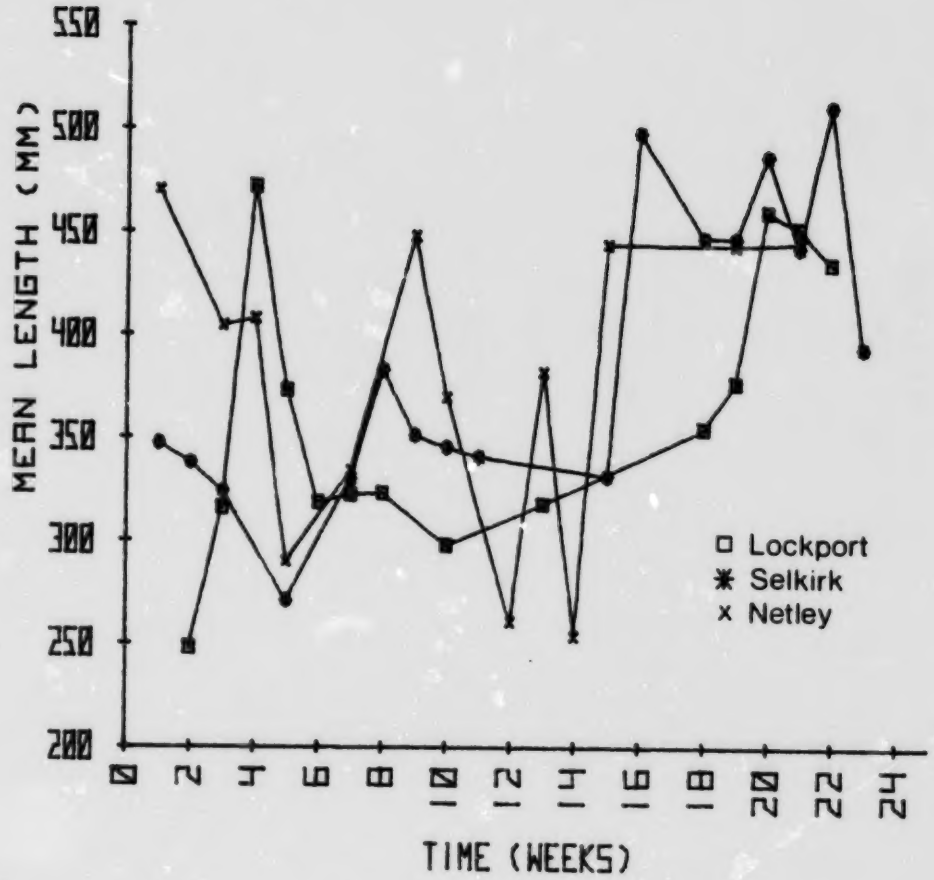


Fig. 28. Seasonal growth curves of walleyes.

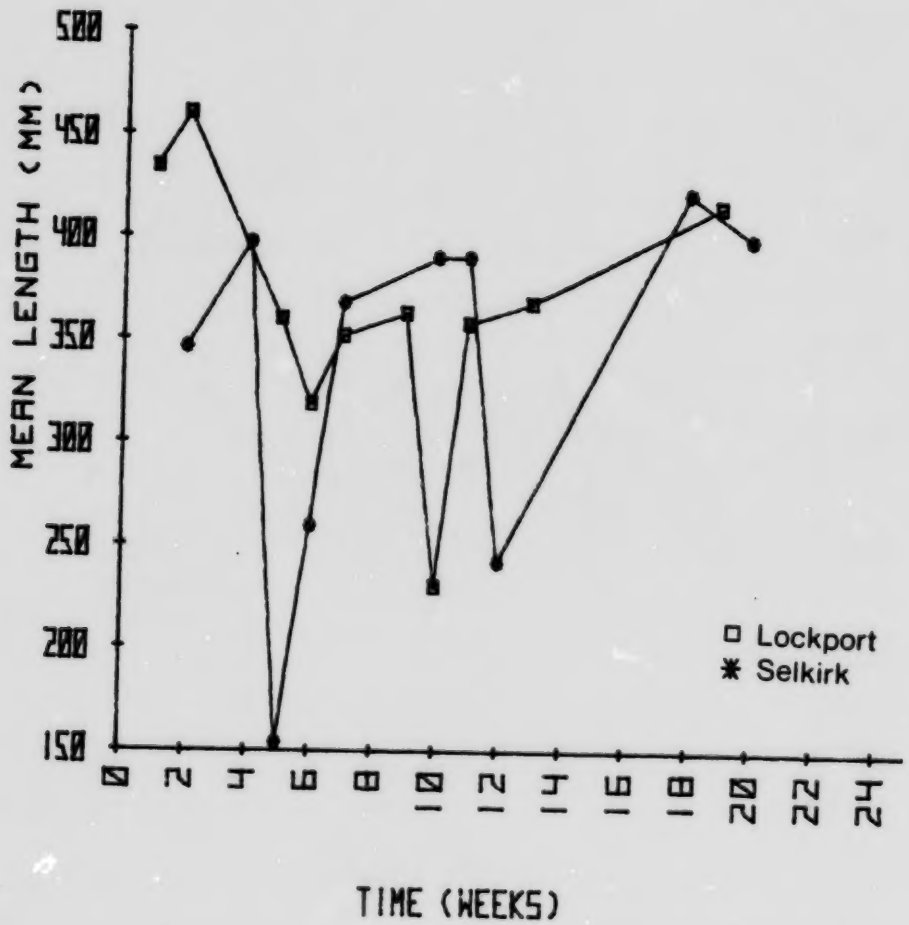


Fig. 29. Seasonal growth curves of suckers.

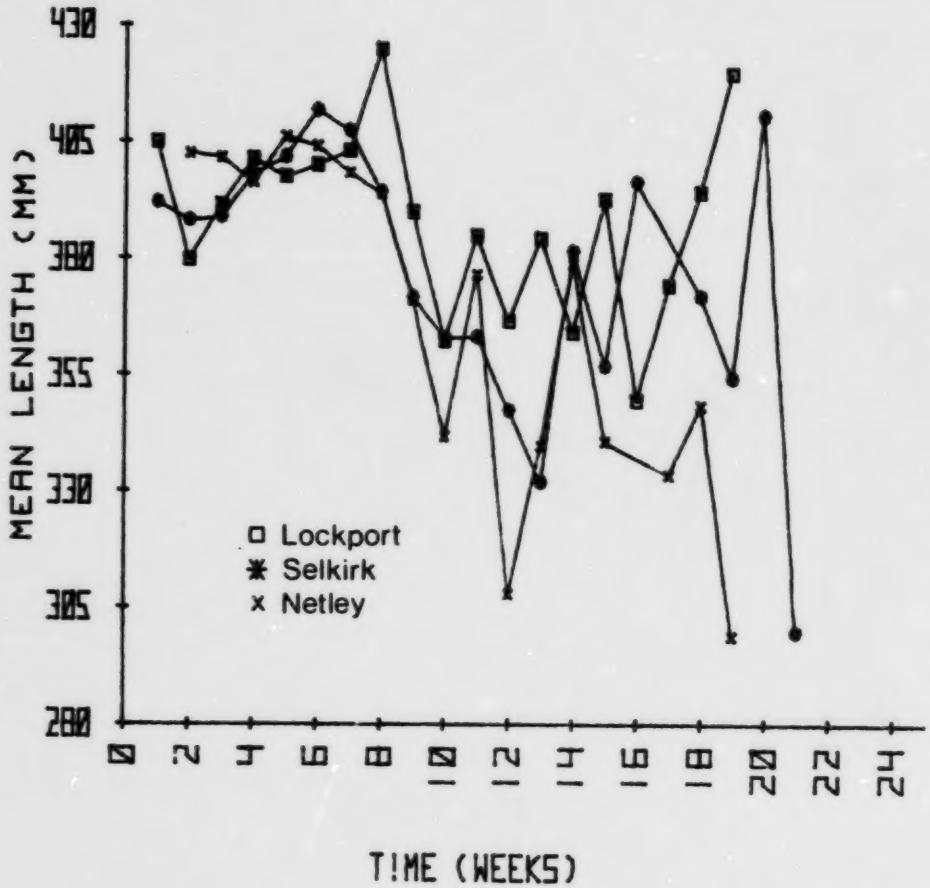


Fig. 30. Seasonal growth curves of freshwater drum.

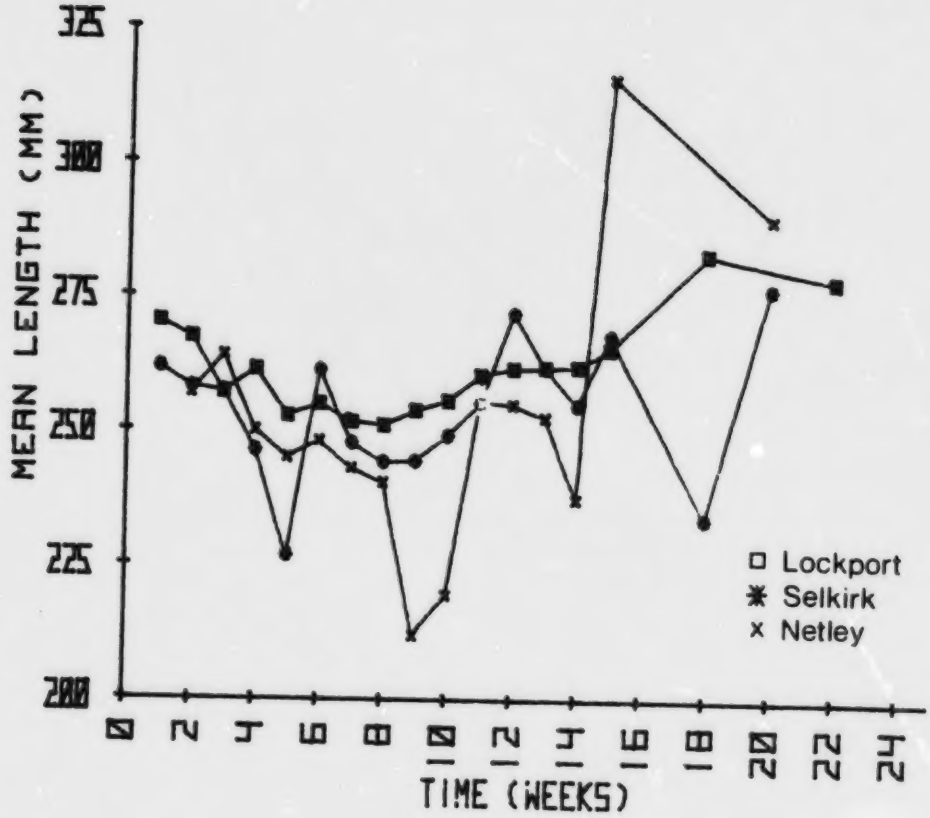


Fig. 31. Seasonal growth curves of goldeyes.

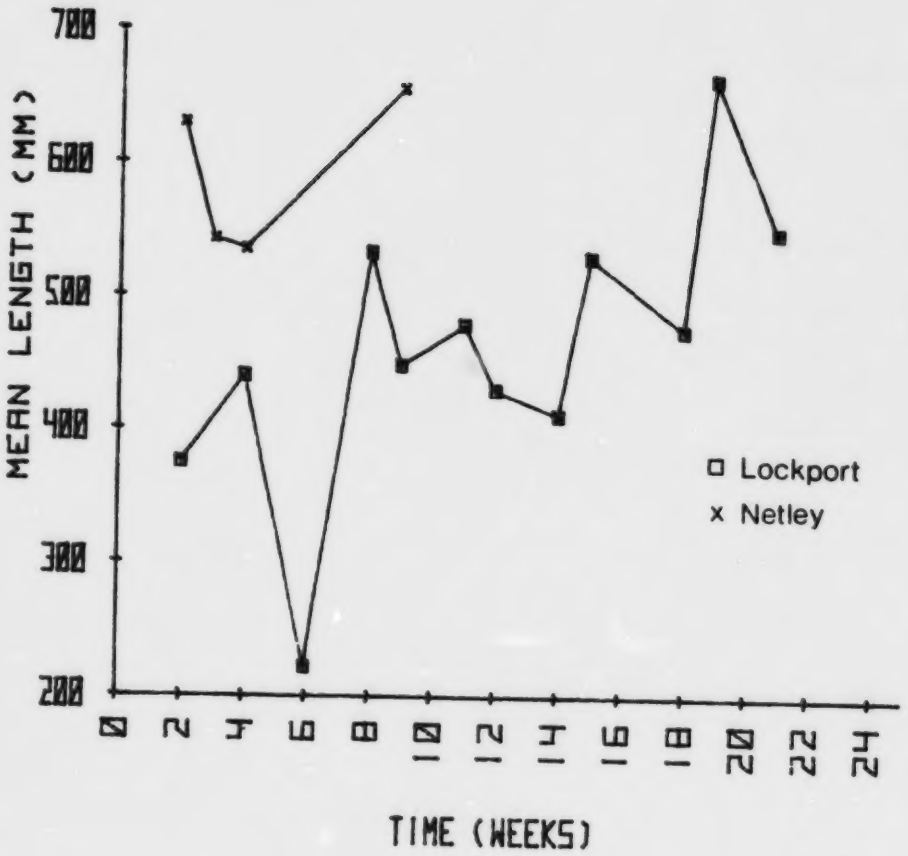


Fig. 32. Seasonal growth curves of northern pike.

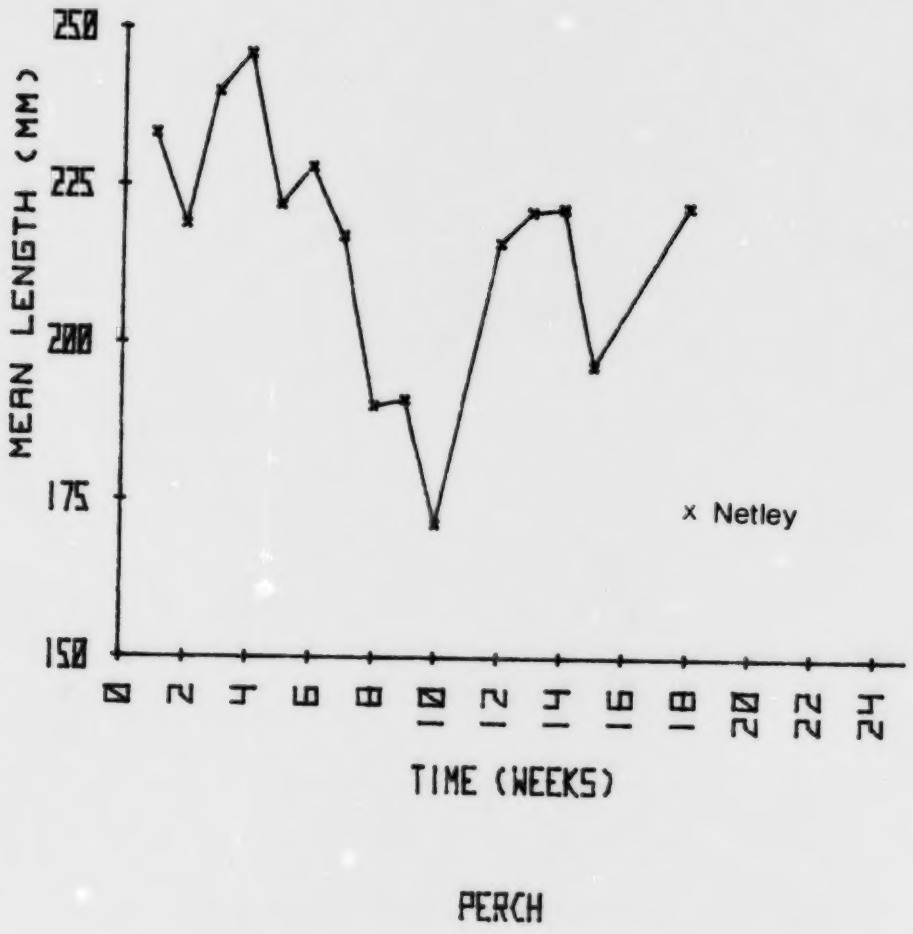


Fig. 33. Seasonal growth curves of yellow perch.

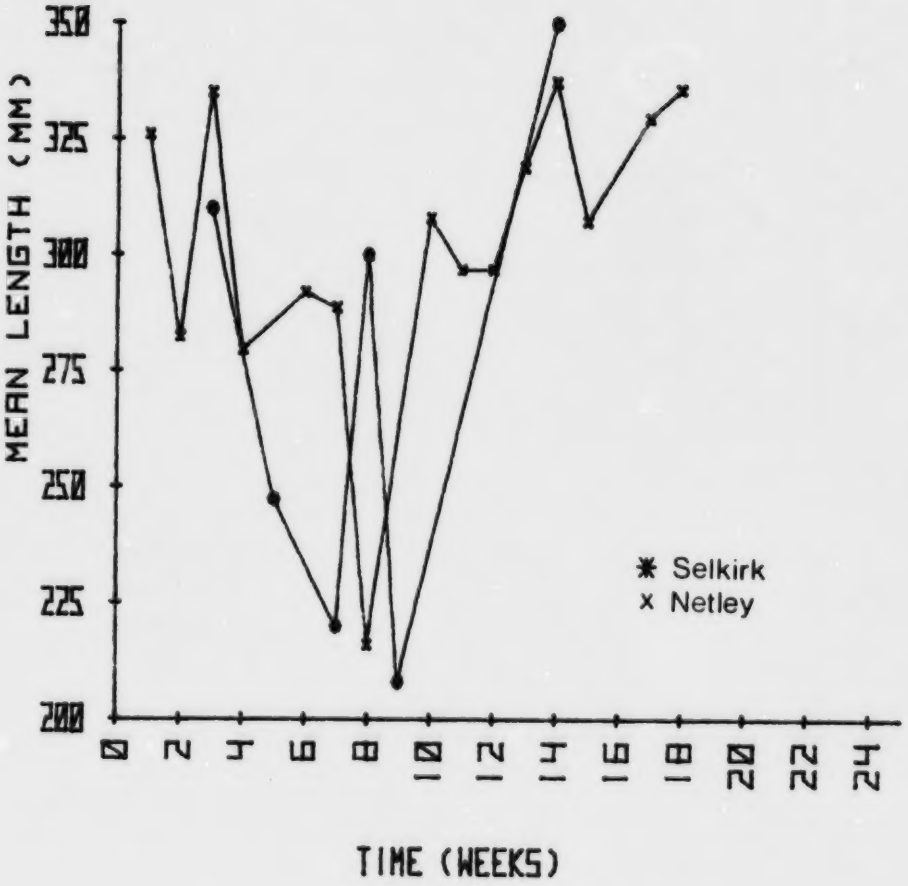


Fig. 34. Seasonal growth curves of bullheads.

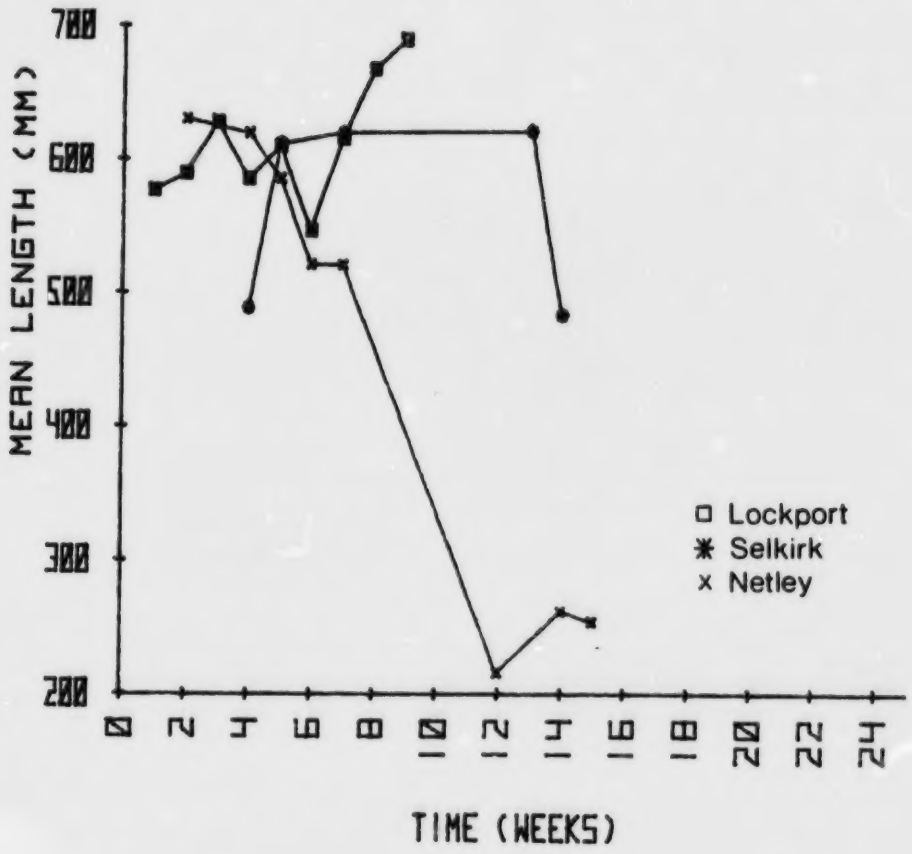


Fig. 35. Seasonal growth curves of carp.

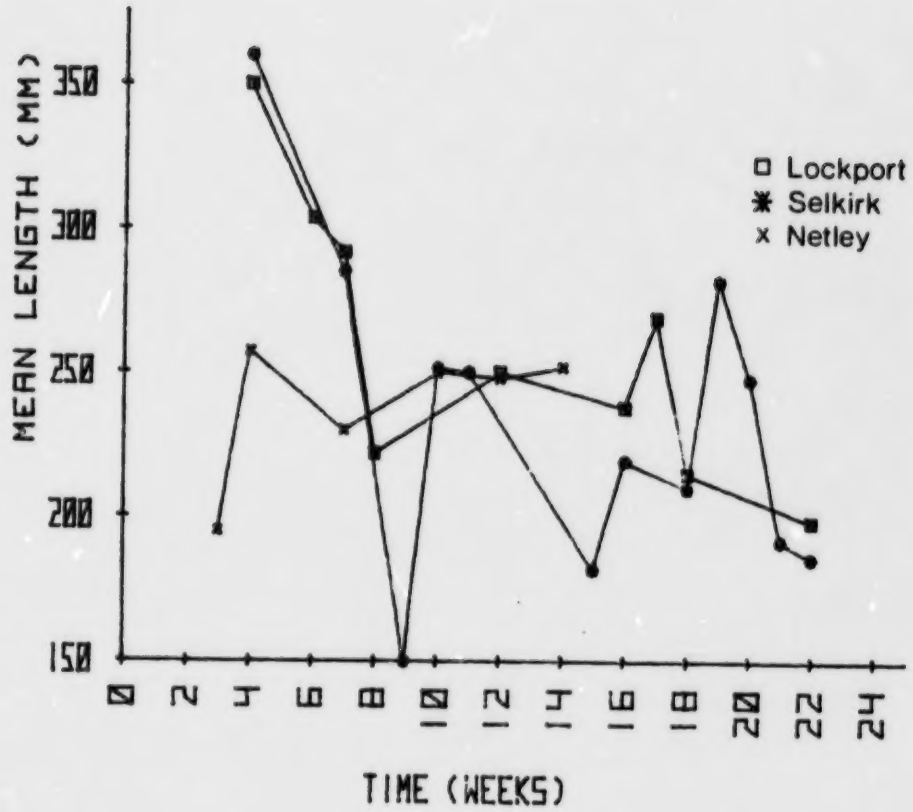


Fig. 36. Seasonal growth curves of white bass.

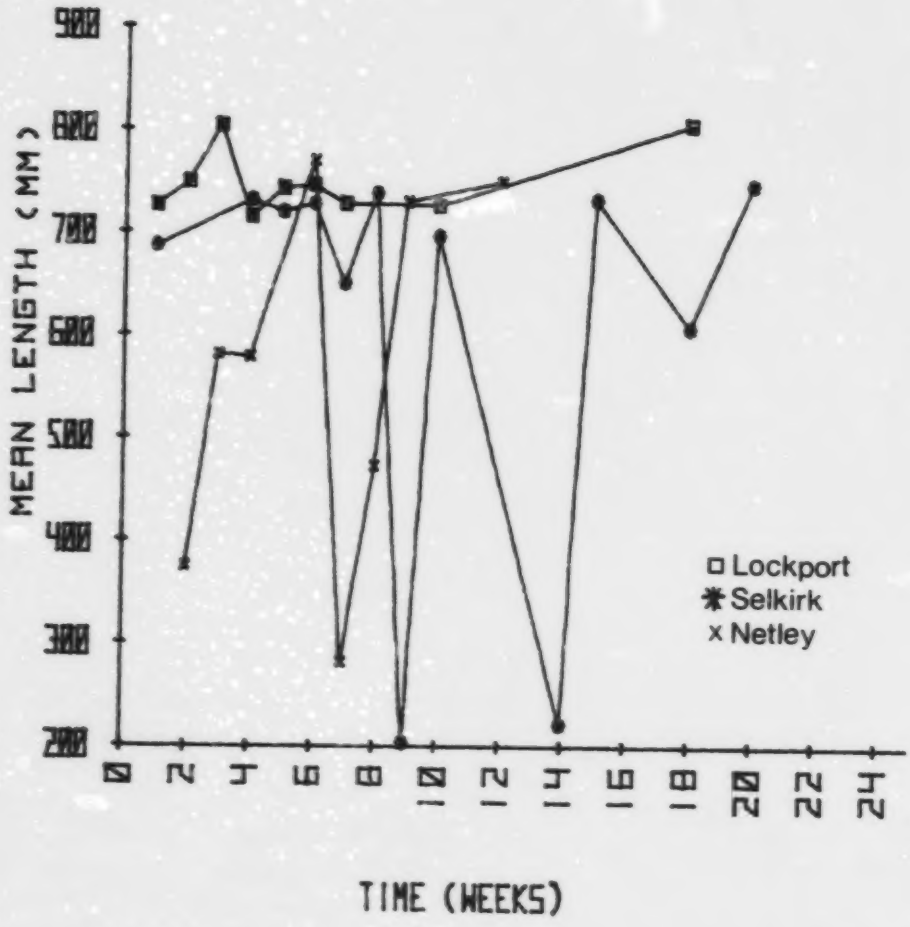


Fig. 37. Seasonal growth curves of channel catfish.

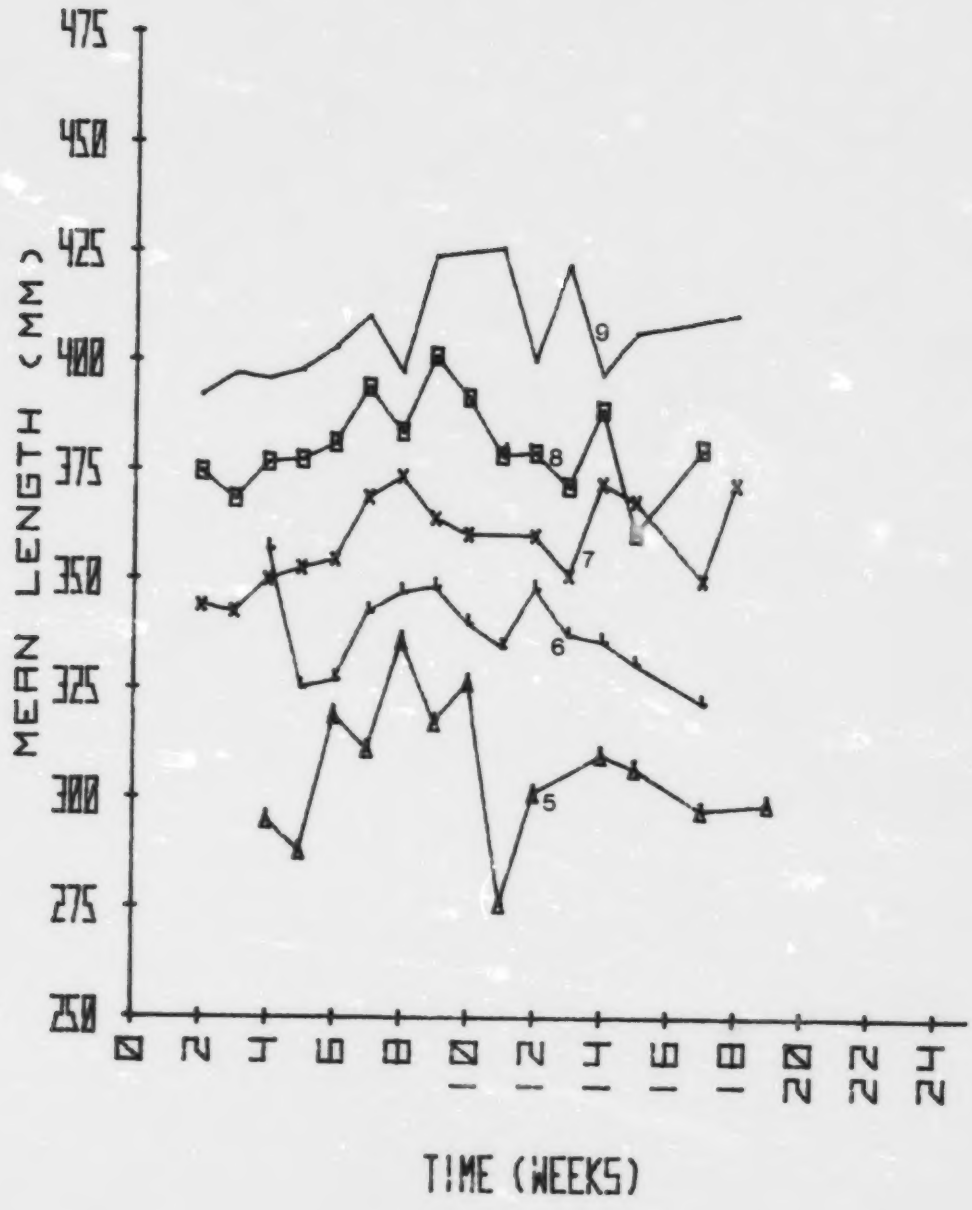


Fig. 38. Age specific seasonal growth curves of Netley freshwater drum.

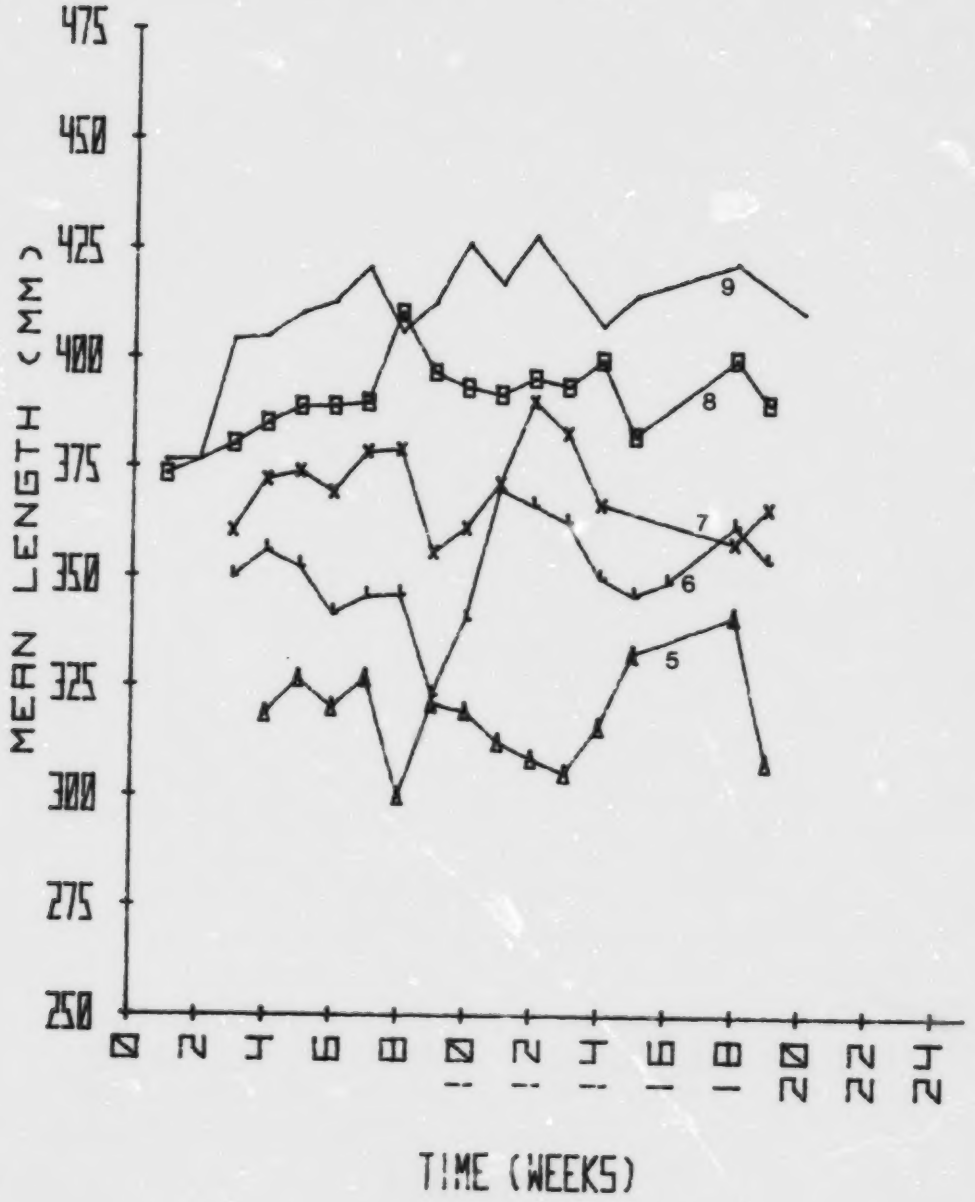


Fig. 39. Age specific seasonal growth curves of Selkirk freshwater drum.

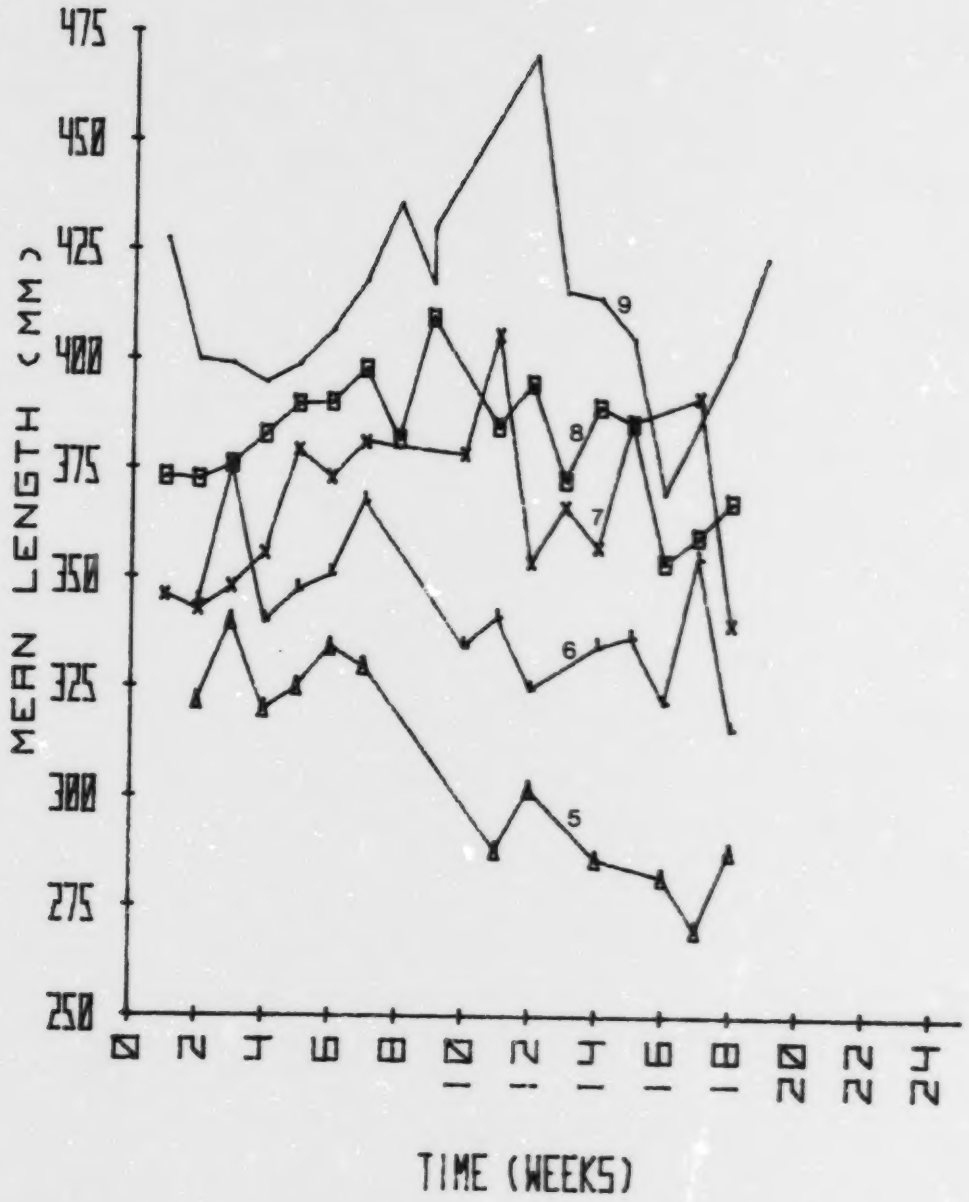


Fig. 40. Age specific seasonal growth curves of Lockport freshwater drum.

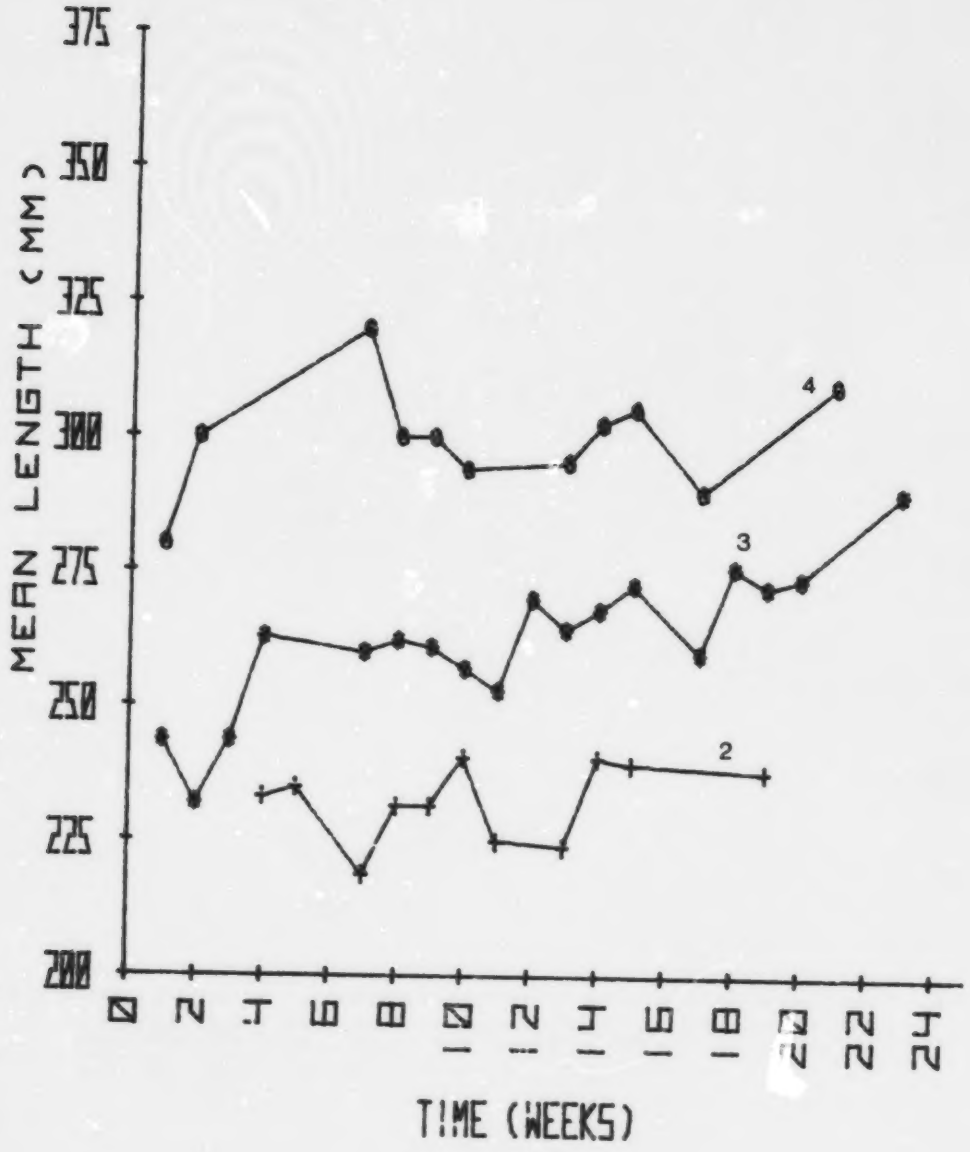


Fig. 41. Age specific seasonal growth curves of Netley saugers.

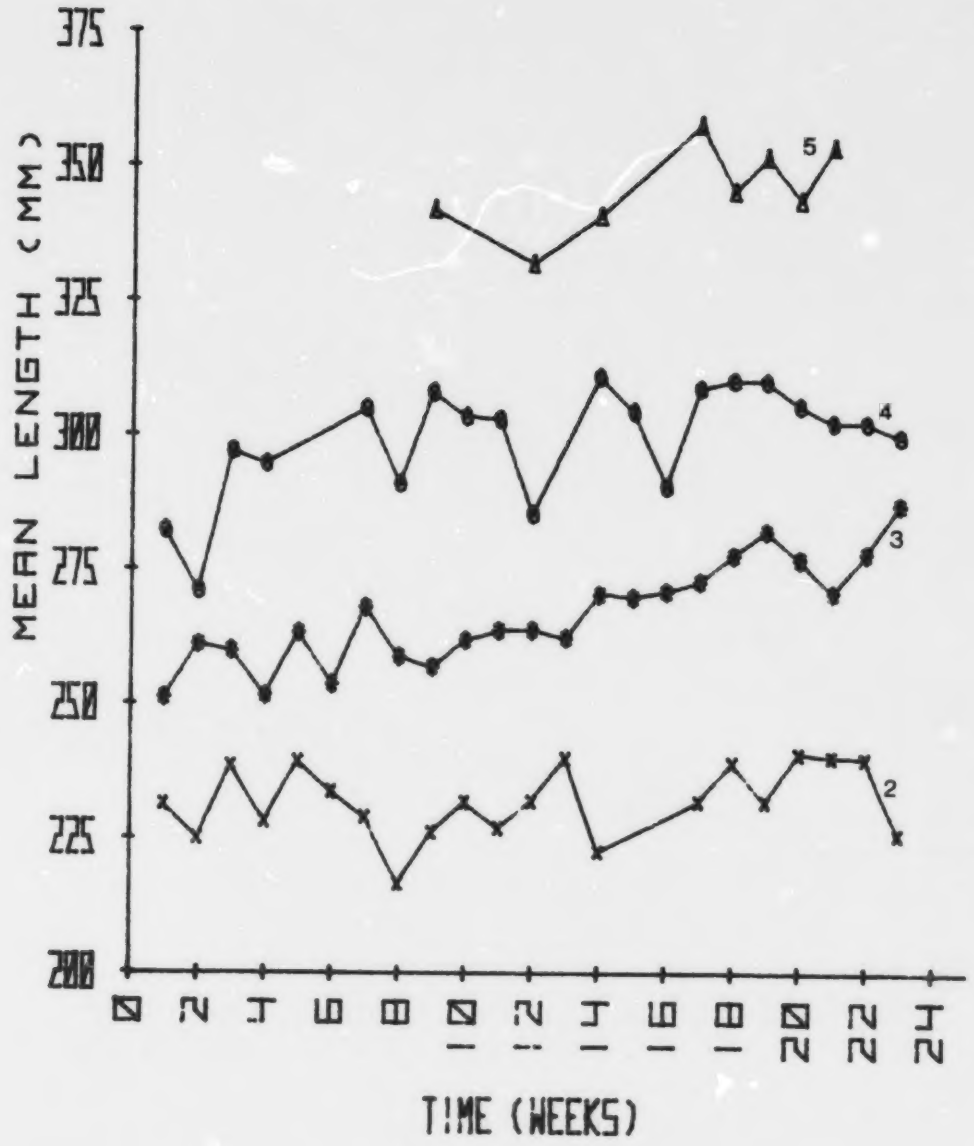


Fig. 42. Age specific seasonal growth curves of Selkirk saugers.

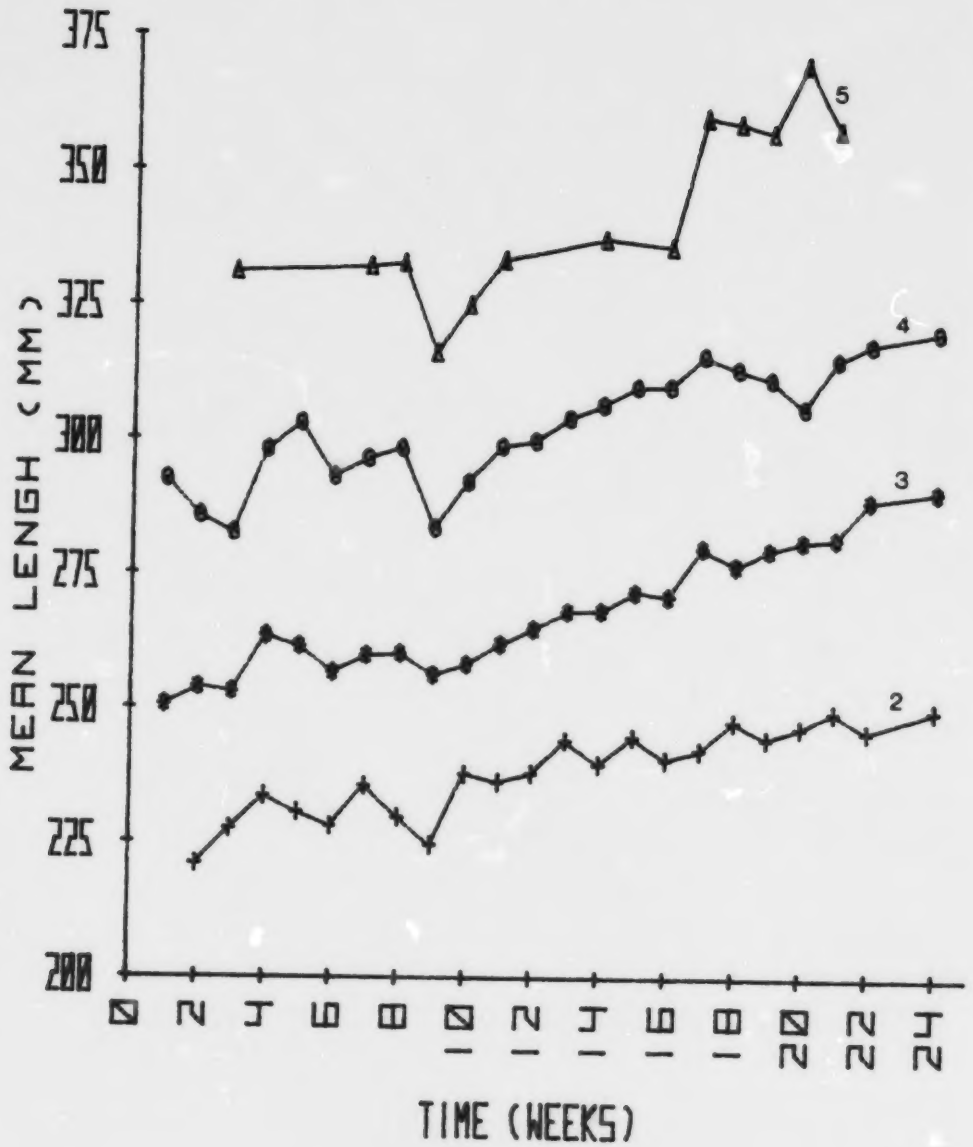


Fig. 43. Age specific seasonal growth curves of Lockport saugers.

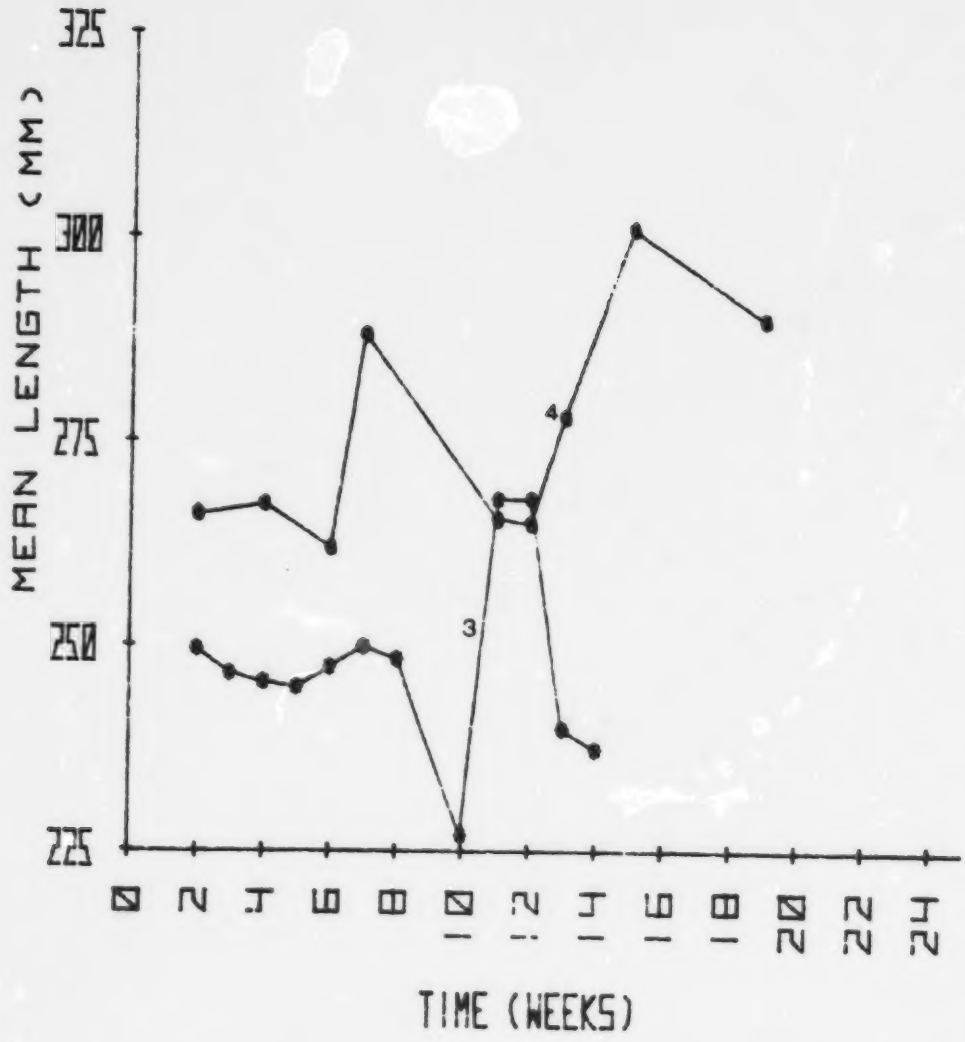


Fig. 44. Age specific seasonal growth curves of Netley goldeyes.

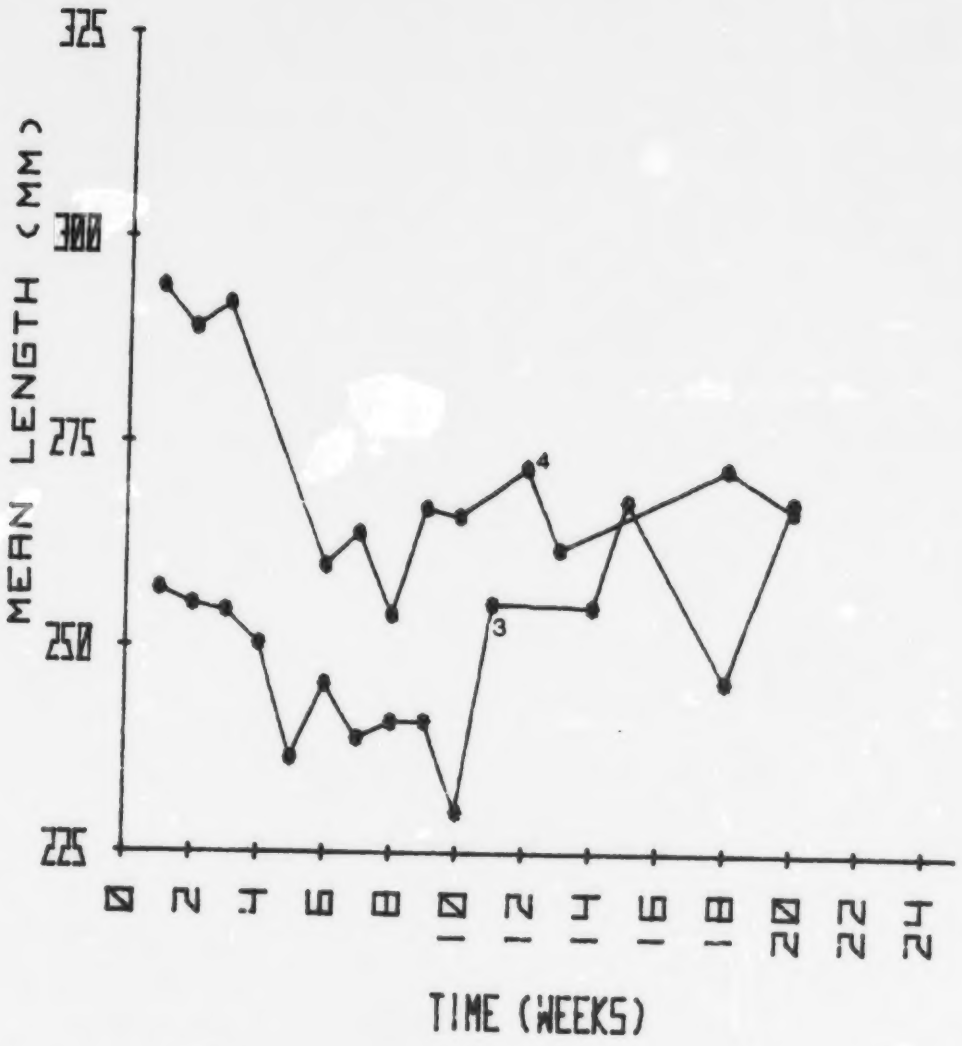


Fig. 45. Age specific seasonal growth curves of Selkirk goldeyes.

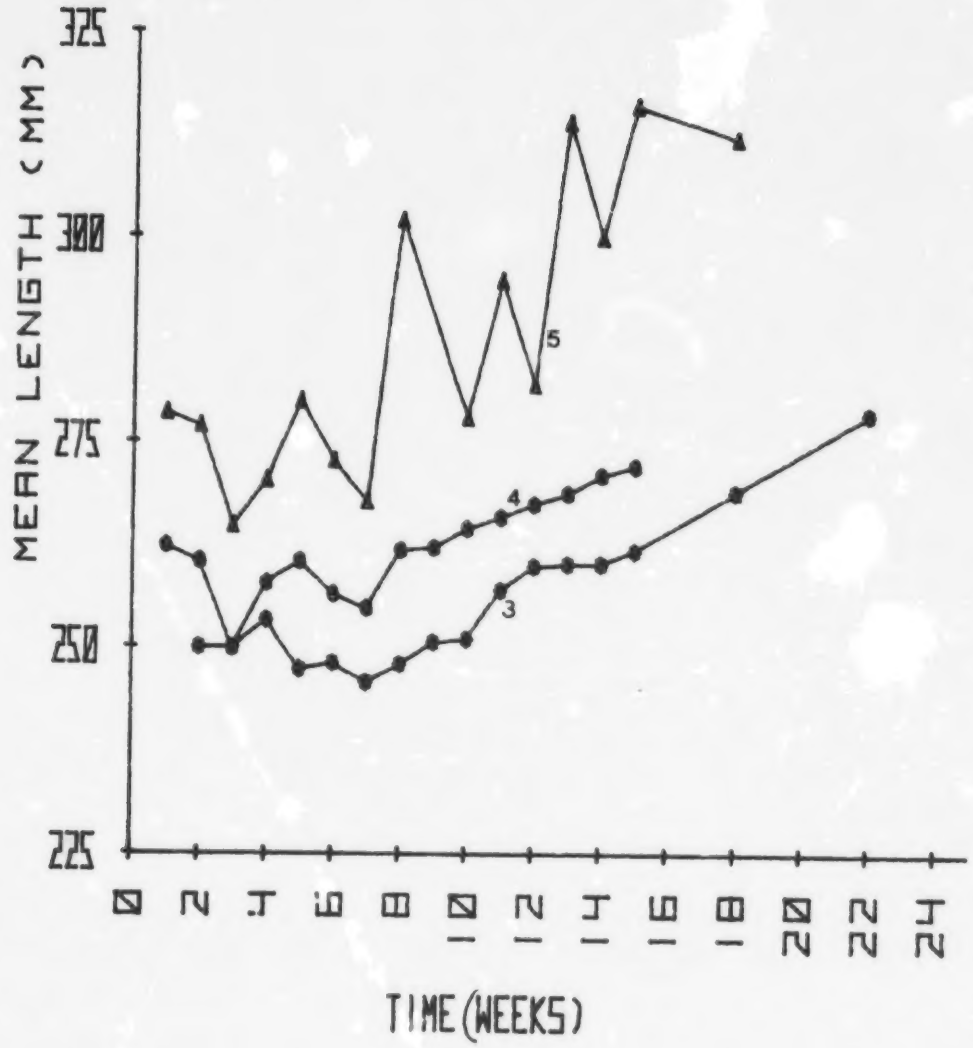


Fig. 46. Age specific seasonal growth curves of Lockport goldeyes.

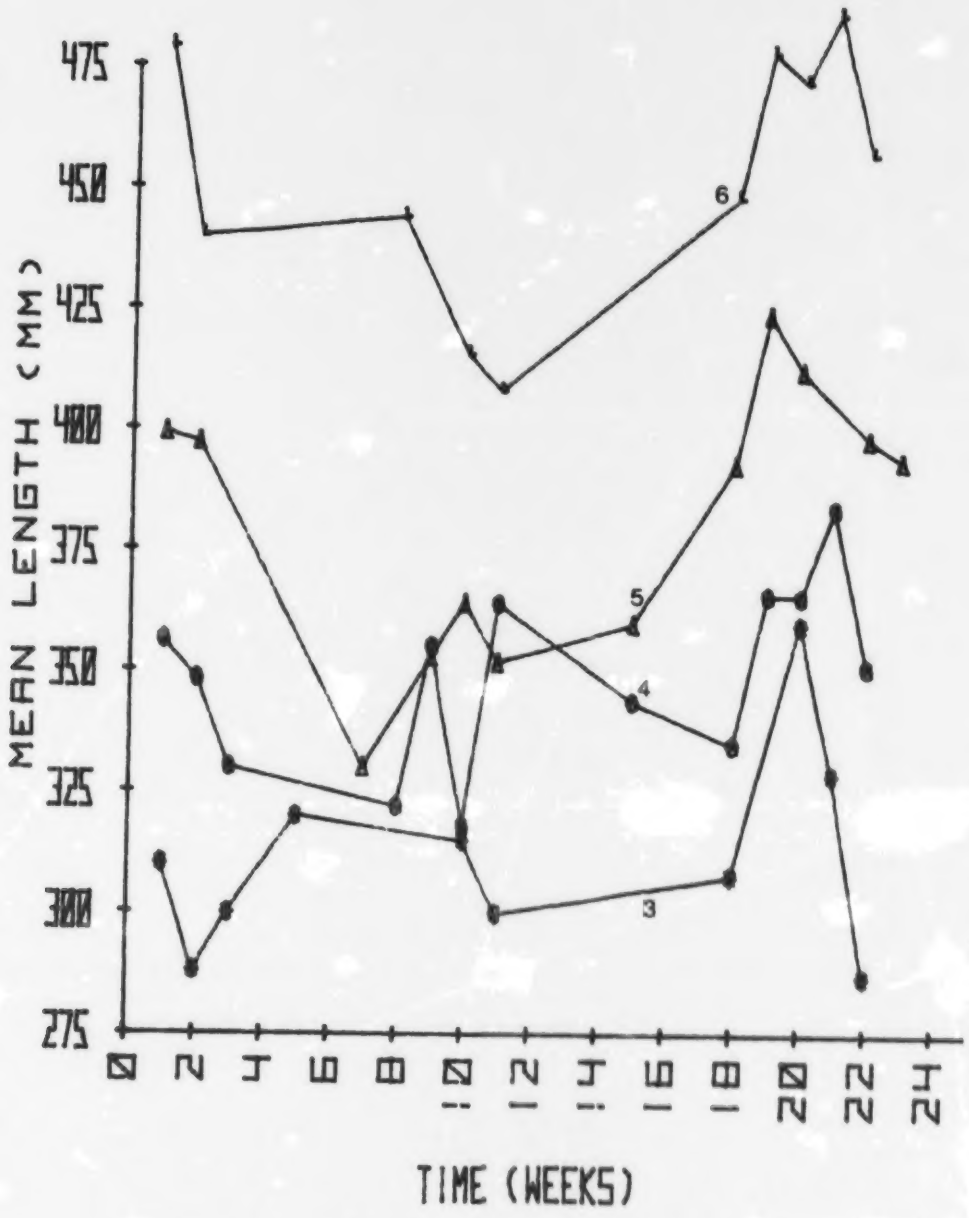


Fig. 47. Age specific seasonal growth curves of Selkirk walleyes.

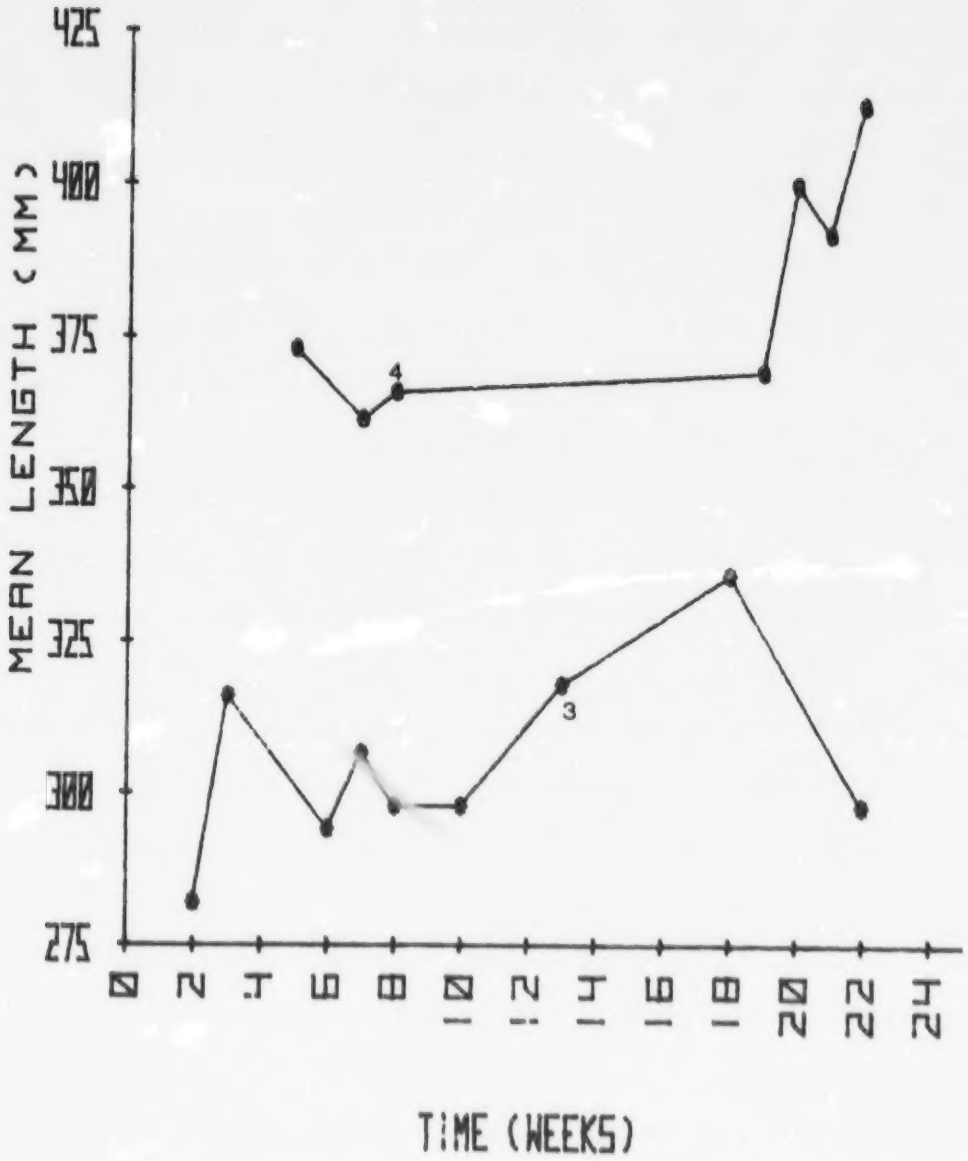


Fig. 48. Age specific seasonal growth curves of Lockport walleyes.

Age compositions and catch curves

The temporal deterioration of freshwater drum catch curves from all three locations revealed the presence of strong 1974 and 1975 cohorts. The irregularly shaped autumnal catch curves from all three areas were due to small sample sizes (Fig. 49).

The 1979 cohort of saugers dominated the Red River fishery throughout the entire season (Fig. 50).

Spatial and temporal gaps created by anglers' refusal to retain carp and bullheads precluded the development of comprehensive catch curves. The age compositions of Netley bullheads indicated the presence of a strong 1978 cohort (Figs. 51, 52).

Strong 1978 and 1979 walleye cohorts were evident in the vernal catch curves from Lockport and Selkirk. Dominance of the 1979 cohort continued at Lockport in the fall but shifted to the 1974 - 76 cohorts at Selkirk and Netley (Fig. 53).

The few yellow perch retained by anglers were primarily members of the 1979 and 1980 cohorts (Fig. 54). Spring and summer catch curves of goldeyes revealed a strong 1979 cohort at all three locations (Fig. 55).

Long lived members of the 1967 and 1968 catfish cohorts appeared to dominate the spring samples collected at Lockport and Selkirk (Fig. 56).

The 1975 - 76 cohorts of white bass were abundant at Lockport in the spring while the 1979 and 1980 cohorts of white bass were dominant at Selkirk in summer (Fig. 57).

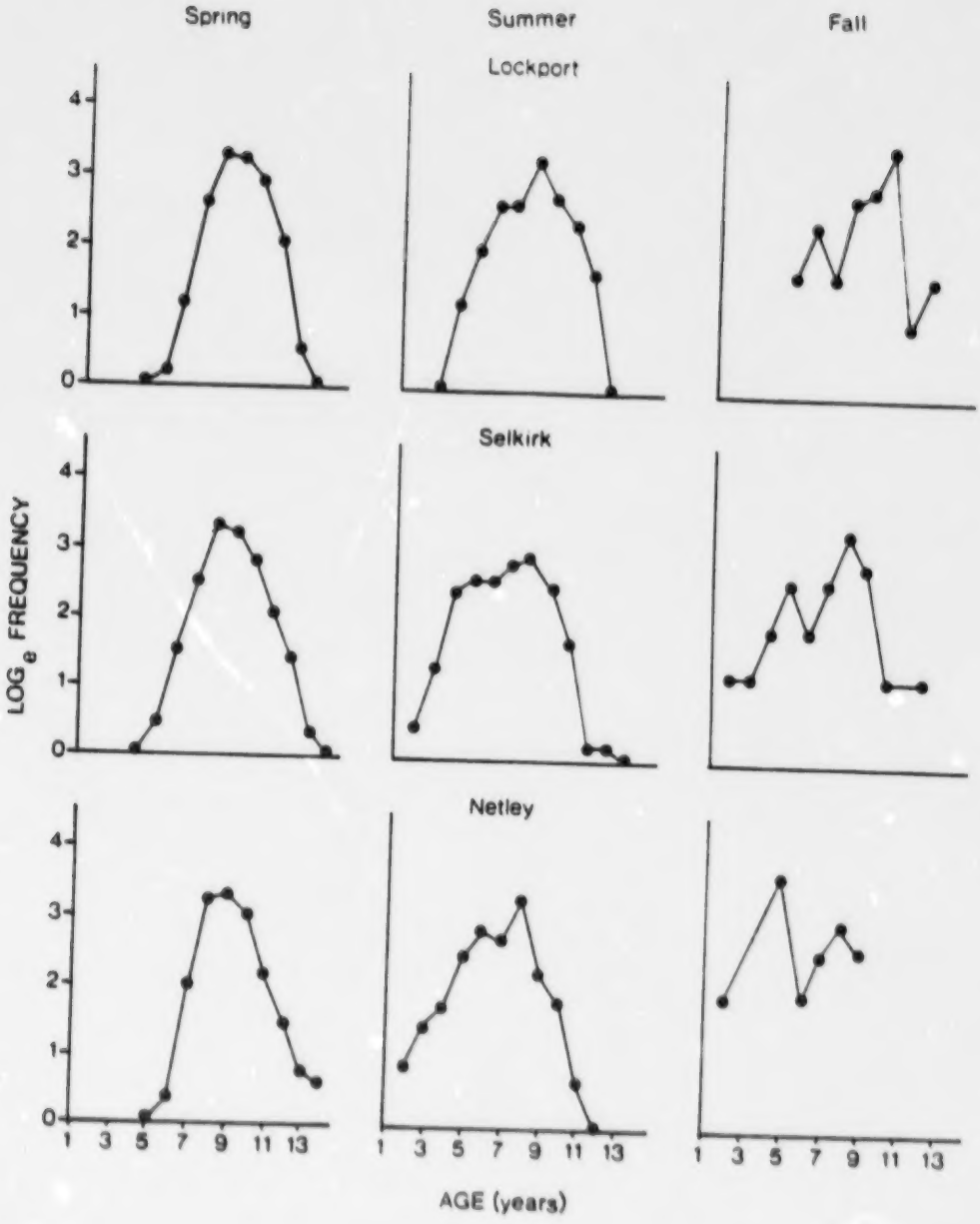


Fig. 49. Spatial and temporal changes in freshwater drum catch curves.

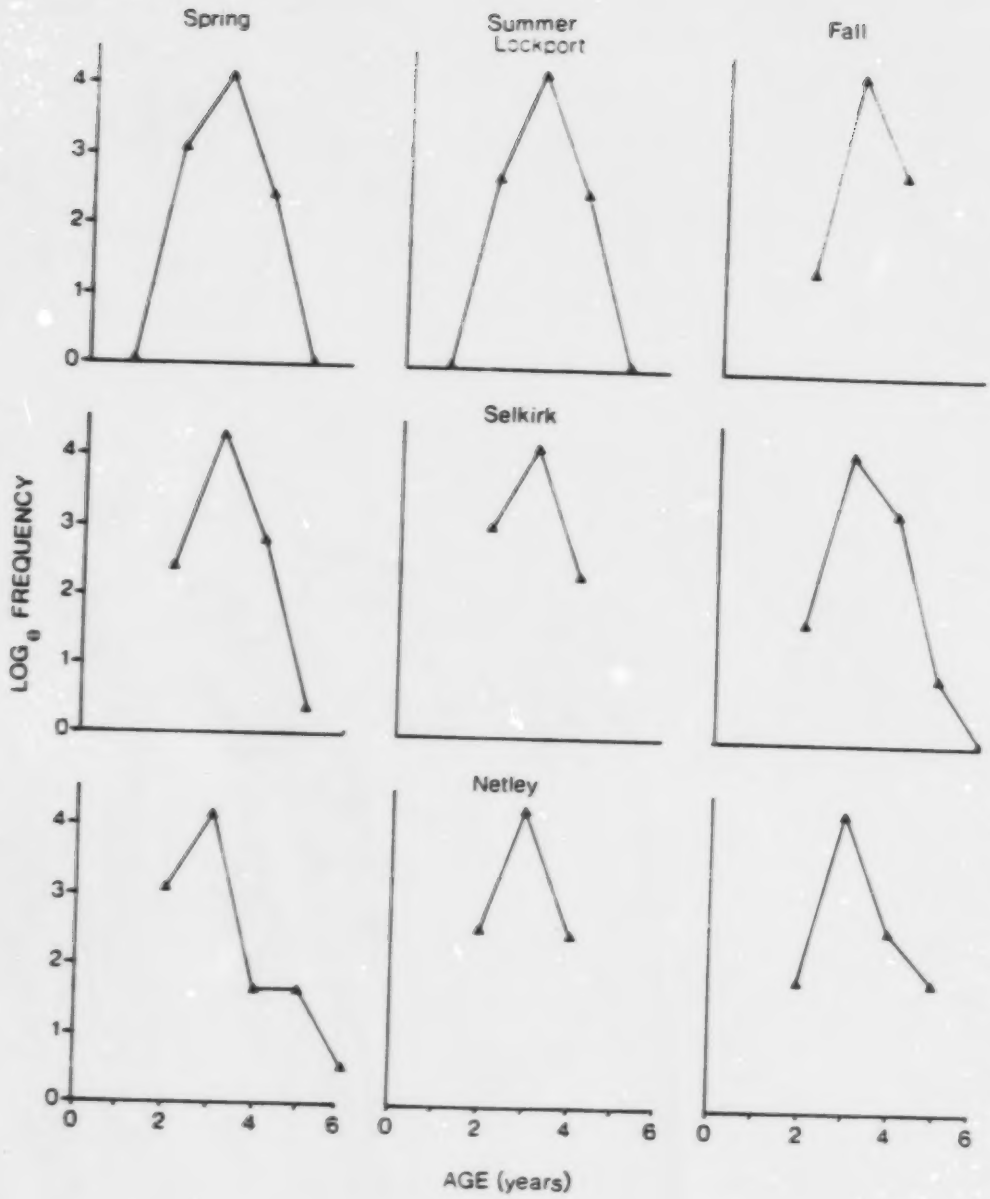


Fig. 50. Spatial and temporal changes in sauger catch curves.

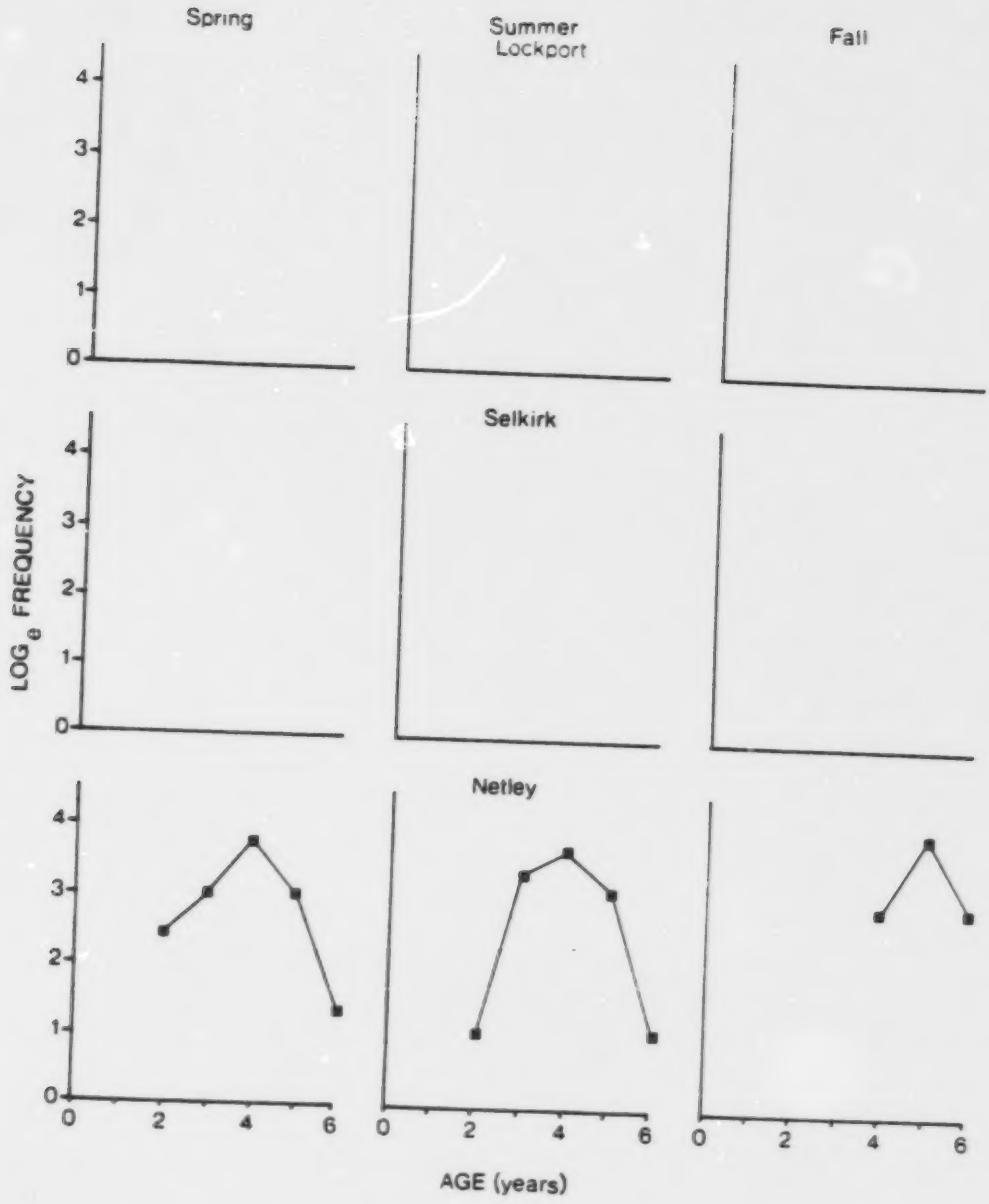


Fig. 51. Spatial and temporal changes in bullhead catch curves.

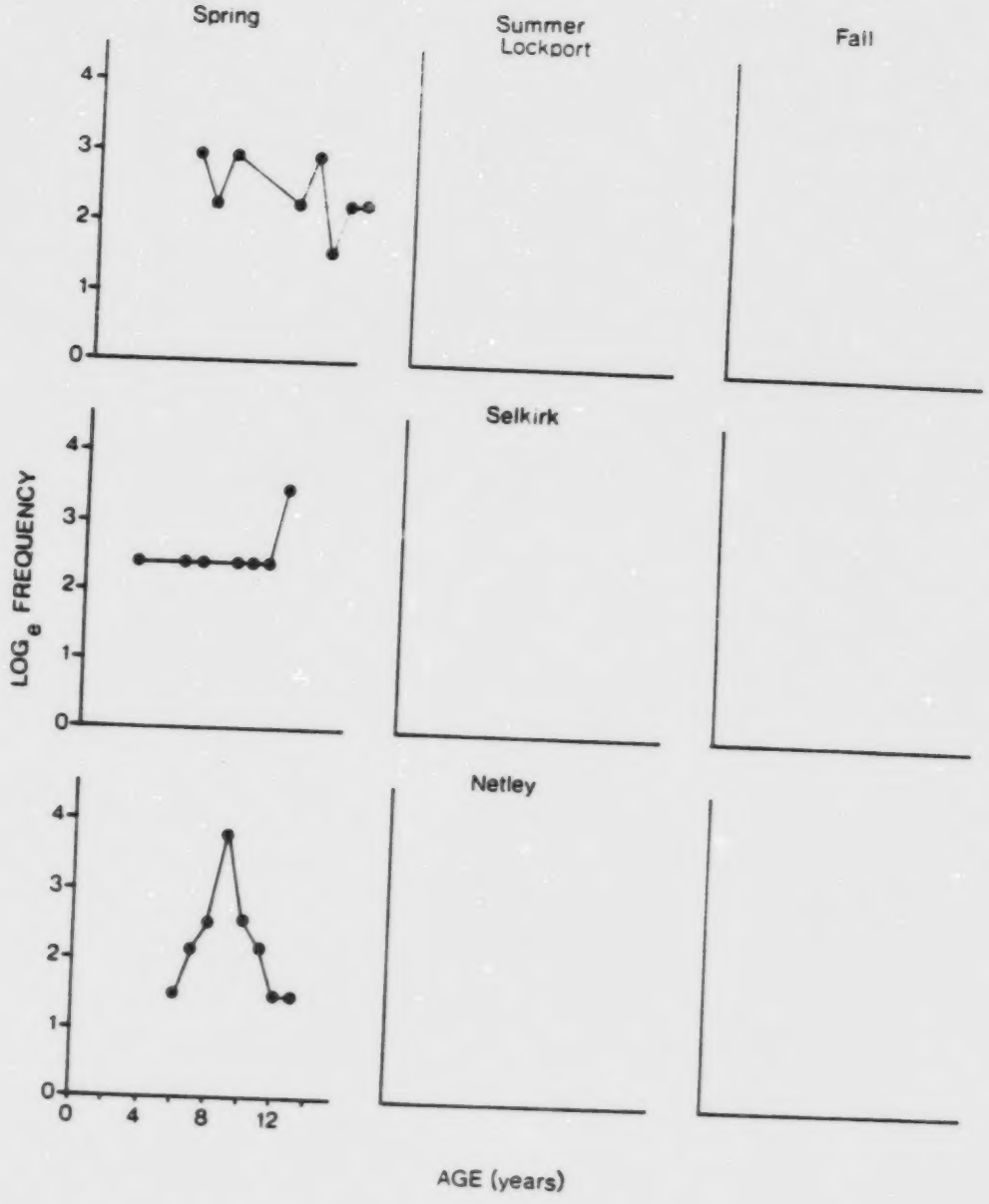


Fig. 52. Spatial and temporal changes in carp catch curves.

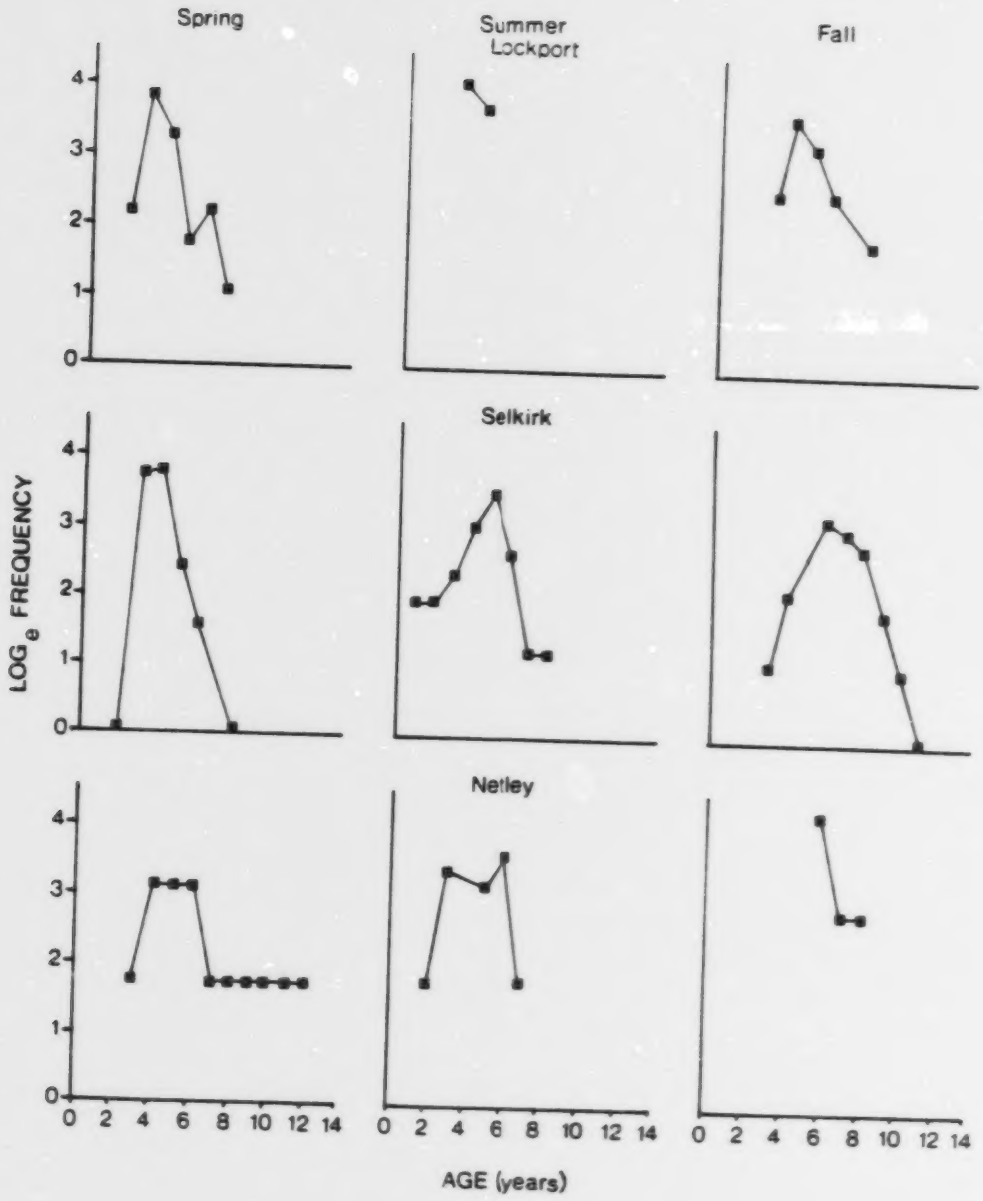


Fig. 53. Spatial and temporal changes in walleye catch curves.

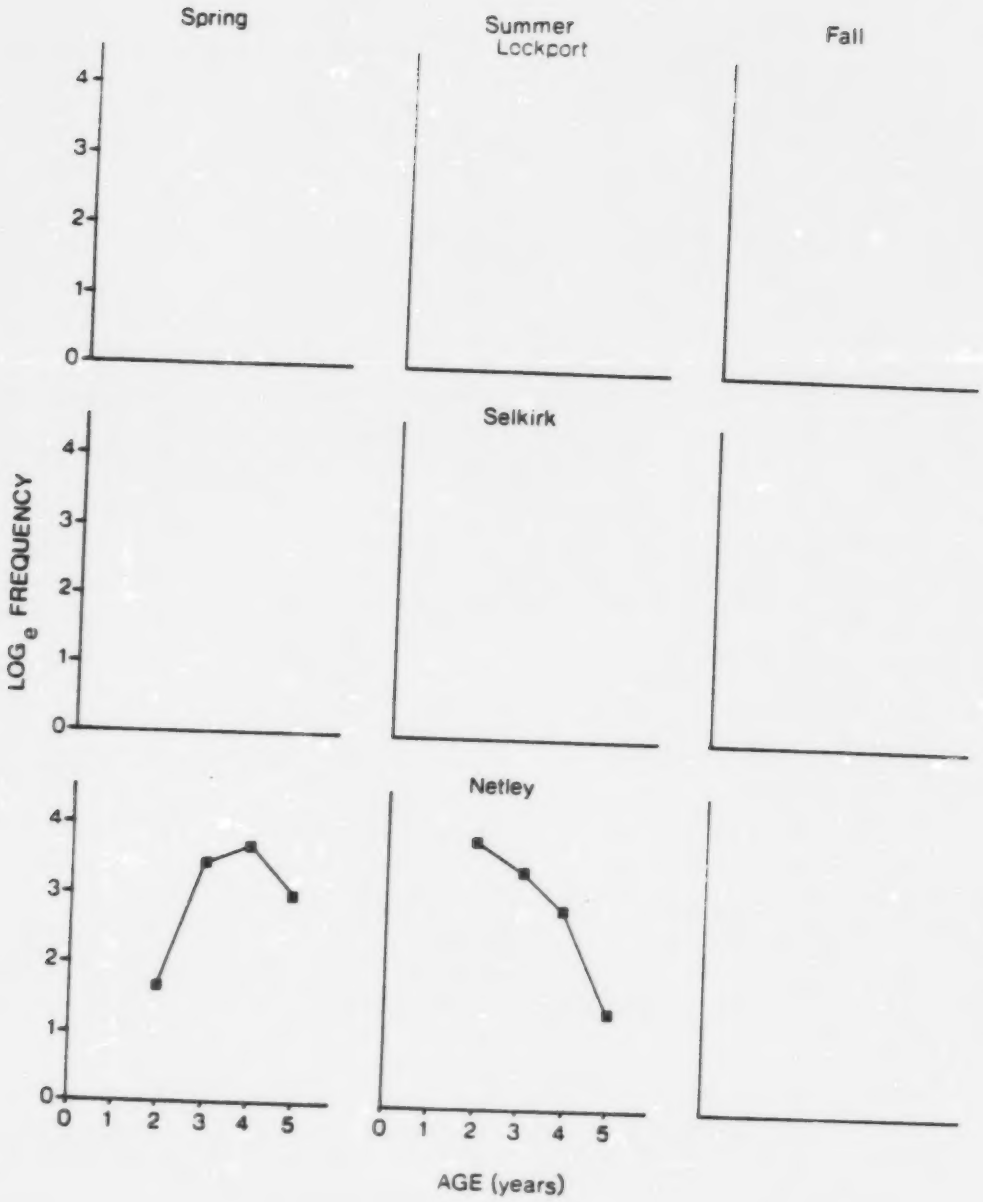


Fig. 54. Temporal changes in yellow perch catch curves.

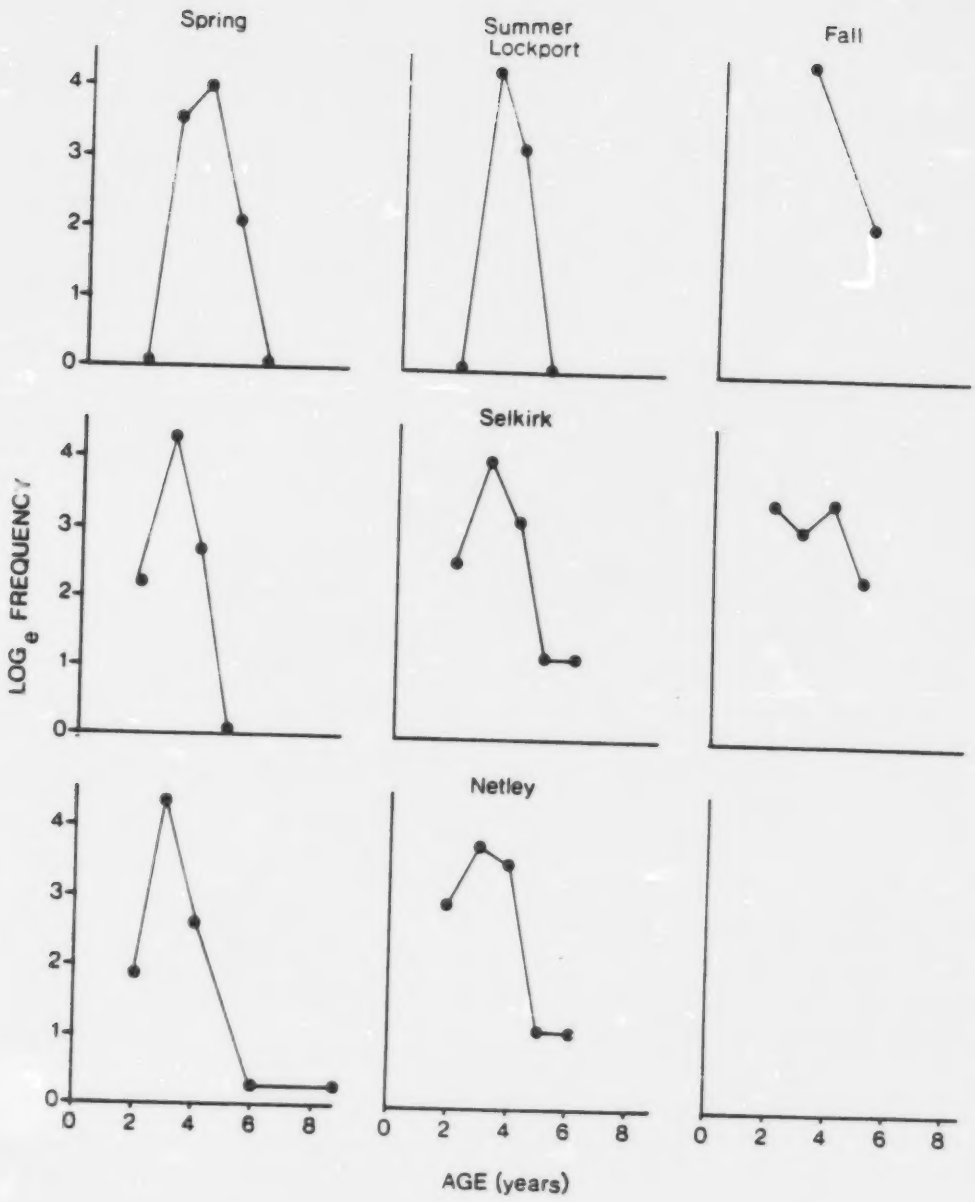


Fig. 55. Spatial and temporal changes in goldeye catch curves.

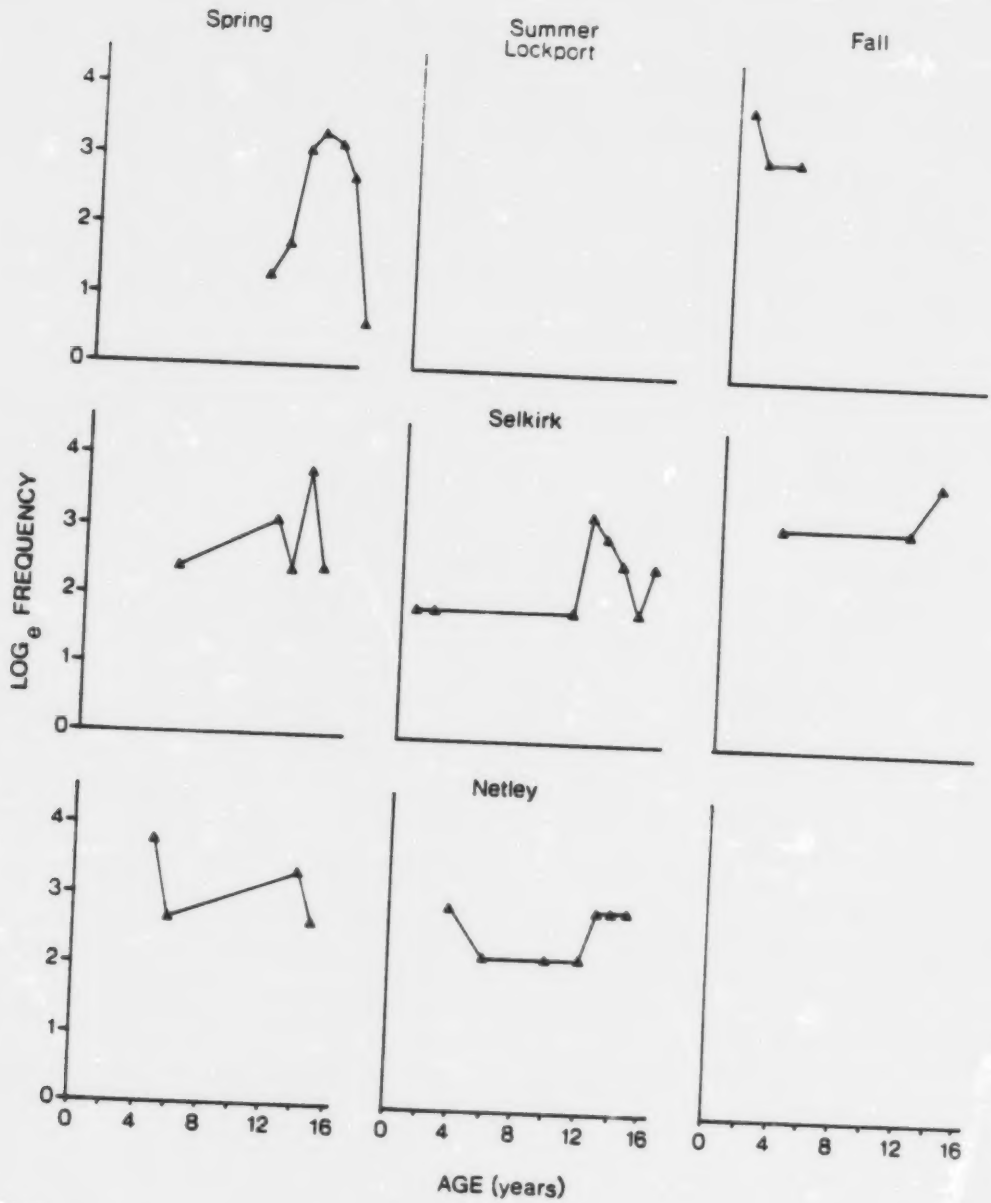


Fig. 56. Spatial and temporal changes in channel catfish catch curves.

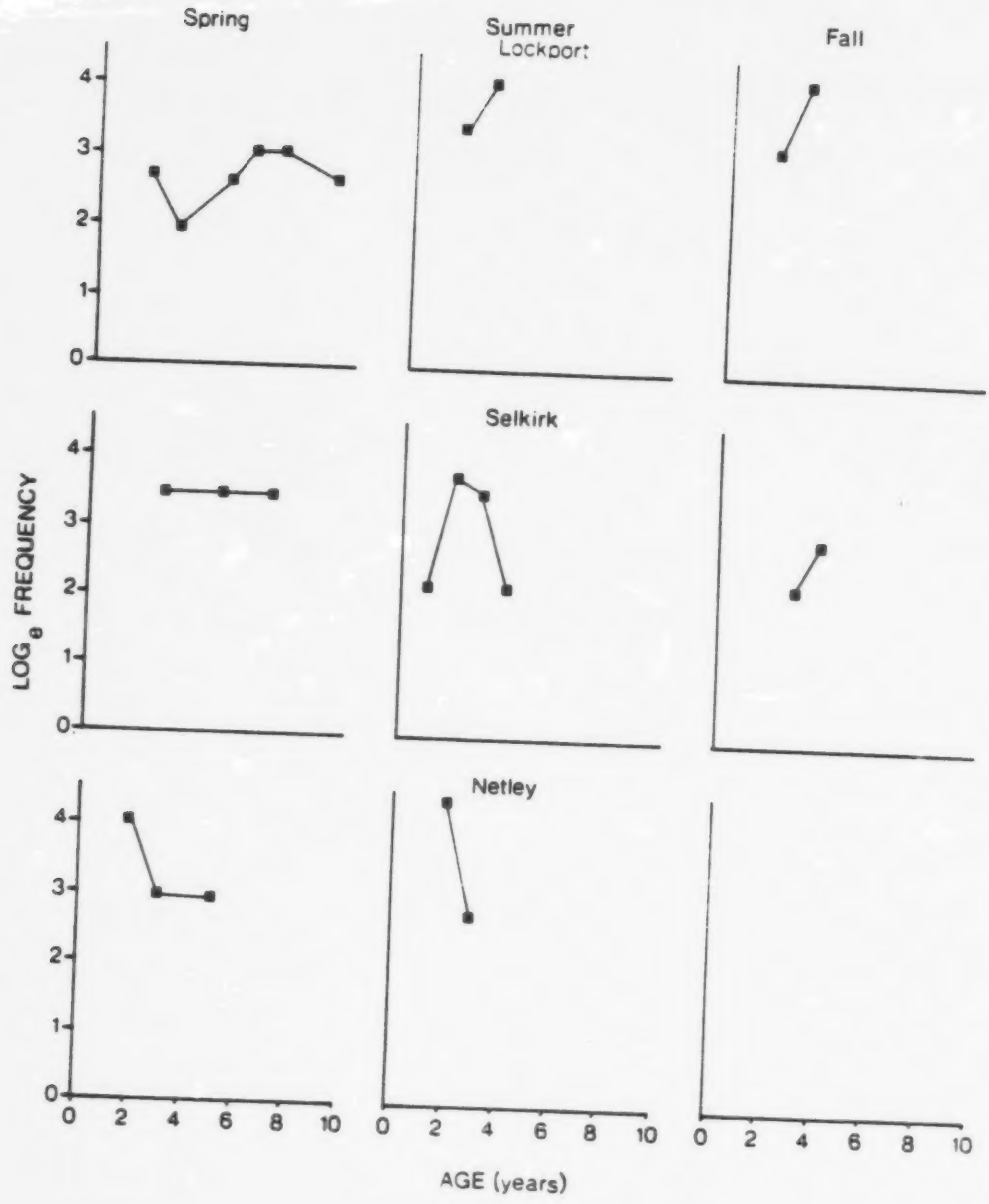


Fig. 57. Spatial and temporal changes in white bass catch curves.

Sample sizes of other species observed in anglers' catches were too small to permit meaningful analysis. Age-specific frequencies and mean body size measurements of all sampled species are listed in Appendix D.

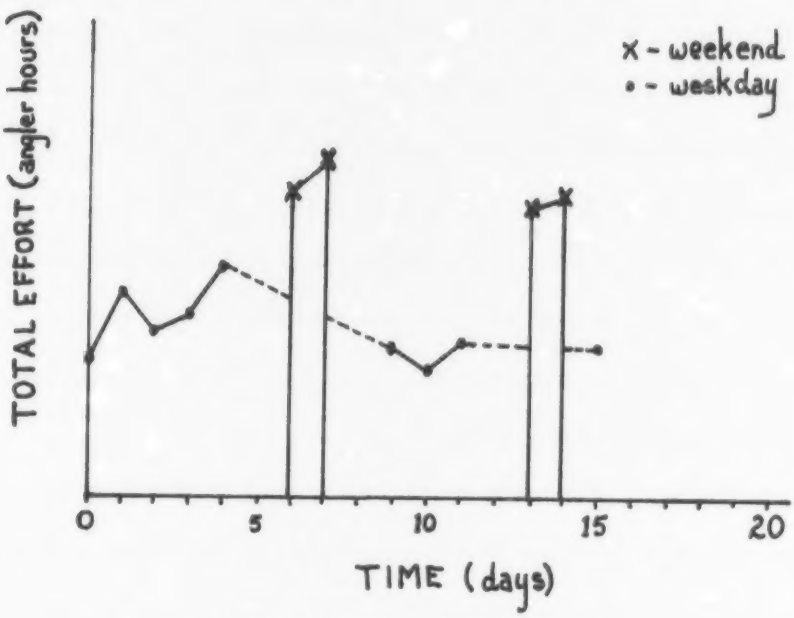
DISCUSSION

Angling effort exerted at Lockport, Selkirk and Netley Creek during the 1982 - 83 angling seasons was estimated to be 336,626 angler hours. 285,933 angler-hours were exerted during the open water season and 50,693 angler-hours were exerted in winter. The angling effort exerted on this relatively small stretch of the Red River was 91,626 angler-hours more than that estimated for sport fisheries on Lake Winnipegosis, Waterhen Lake, Lake Manitoba, Lake St. Martin and the Dauphin River in 1977 (Valiant and Smith 1979). Red River anglers removed 112,445 kg of fish from the river during the 1982-83 season. This harvest comprised approximately 2.8% of the entire Manitoban angling harvest (Green and Derksen 1984).

The two major components of angling effort are numbers of fishermen and angling duration. Mean angling durations observed on the Red River did not vary substantially with time or among locations except during the Selkirk autumnal fishery. Longer angling durations in this case were attributed to fishing derbys. Mean daily total effort exerted during weekends was consistently higher and usually more variable than during weekdays at all locations. Angling effort declined from spring to summer and increased in autumn. Mean daily total effort exerted during winter tended to be slightly lower than during summer at most locations. Mean angling durations were low in January and increased in February and March.

The estimation of total angling effort exerted at a particular sampling location was provided by the product of N and weighted stratified

random mean values. Another approach to estimating total effort may be to integrate the curves of daily observed total effort plotted versus time (days). Weekend days would have to be treated separately as follows:



A system for interpolating values for unsampled days adjacent to weekend days would have to be devised. Perhaps the weakest point in the estimation of angling parameters is the estimation of effort. Many anglers sampled during the Red River survey were not aware of their angling duration and merely provided intuitive guesses. This undoubtedly created anomalies when CUE values (based on reported effort) were extrapolated to total catch values (based on number of anglers observed at various times during the day). Low precision also resulted when n_h values were less than 3 days.

Attempts to relate daily amounts of rainfall and angling effort were futile since it is not only the amount of rain but also the time and duration of rainfall that conceivably affects daily angling effort.

The Red River fishery is unique in Manitoba because of its close proximity to major urban areas. This situation provides opportunity for major abuse of the fishery since it is easy and unexpensive for an angler to return several times each day to catch more fish than prescribed in the daily catch limits. This also makes it impossible to determine "angler turnover rates" which would be useful in determining the precision of reported angling durations.

Only retained catches were sampled during this survey since it was observed that most fish that were caught were retained. In many instances, we observed that burbot and bullheads were discarded on the shore and were not retained by anglers. Many anglers were also observed either discarding, returning to the water or giving to other anglers their catches of freshwater drum.

The species composition of retained catches changed dramatically from the open water season to the winter season. The frequencies of retained pike and perch were higher in winter. Saugers dominated winter catches (in terms of abundance). Freshwater drum, goldeyes, catfish, bullheads and white bass were conspicuously absent from winter catches.

The relative importance of each fish species' contribution to the angler harvest depends on whether one considers numerical abundance or weight. For example, 935 carp contributed 4440 kg to the harvest while 40357 goldeyes contributed 7951 kg. The results of most Manitoban

creel surveys have been traditionally reported in terms of numbers of fish caught per angler-hour. Hagenson and O'Connor (1978) reported catch rates of 0.86-1.65 pike and 0.47-0.70 walleyes per angler-hour on God's Lake in northern Manitoba. Lake trout, brook trout and whitefish were also present in the fish community. Reed Lake anglers removed 0.43 walleyes and 1.58 pike per angler-hour and exerted 15,088 angler-hours of effort. Lake trout were also present in Reed Lake (Bruederlin and Wright 1981). Jardine and Sigurdson (1981) estimated the following CUE values:

	catch/angler-hour	retained catch/angler-hour
Sasaginnigak L.	0.63 walleye 0.30 pike	0.32 walleye 0.14 pike
Fishing L.	0.73 walleye 0.33 pike	0.62 walleye 0.27 pike

Walleye CUE values ranged from 0.12 - 0.57 fish/angler-hour from six waters in west central Manitoba (Valiant and Smith 1979). During 1977 - 1978, Valiant and Smith (1979) estimated that 0.004 - 0.016 saugers, 0.042 - 0.193 pike and 0.002 - 0.013 yellow perh were caught per angler-hour from Dauphin River, Fairford and the Waterhen system.

From more southerly latitudes, 0.042 - 0.054 walleyes and 0.102 - 0.286 saugers were removed per angler-hour from a Minnesotan stretch of the Mississippi River receiving 60,986 angler-hours of fishing pressure per year (Thorn 1984). Osborn and Schupp (1985) reported that walleye CUE values for six Minnesotan lakes ranged from 0.17 - 0.85 fish in summer and from 0 - 1.09 fish in winter. Their three year creel survey of Lake Winnibigoshish yielded the following estimates:

	No/angler-hour	Weight/angler-hour (kg)
pike	0.3	0.46
perch	4.6	0.93
walleye	0.69	0.36

669,765 angler hours were spent on Lake Winnibigoshish per year.

Estimates of catch rates and total catches of other species observed during the Red River survey have not been documented for other Manitoban waters.

Lewis and Henderson (1985) estimated the following angler harvests (kg) for two shallow lakes on the northern shore of Lake Ontario:

	Lake Scugog	Rice Lake
Walleye	4,259	49,432
largemouth bass	1,306	8,975
smallmouth bass	337	2,178
muskellunge	2,932	455
yellow perch	387	53,644
rock bass	236	19,385
pumpkinseed	58	47,367
bluegill	0	13,266
other	869	9,148
	10,383	203,800
effort (angler-hours)	141,303	780,780

A commercial fishery in Rice Lake also removes 19,403 kg. of fish annually.

Thus, the Red River fishery receives the highest amount of angling effort in Manitoba and exploits the most diverse array of species but angling effort and percid yield in more southerly waters are one to two times higher.

Age specific mean lengths and weights of walleyes were very similar to those observed during the 1982 Lake Winnipeg commercial stock assessment program (Lysack, 1983). This implies that the walleyes and saugers exploited by Red River anglers were members of the southern Lake Winnipeg stock.

Age specific seasonal growth curves generally provided more comprehensive growth patterns than size specific growth curves especially for species exhibiting wider age ranges. In spite of large sample sizes freshwater drum cohorts exhibited negative growth during the open water season (Figs. 38 - 40). This phenomenon cannot be attributed to pre and post annulus formation ageing discrepancies since such discrepancies would create positive growth patterns. Thus, larger, faster growing members of freshwater drum cohorts are exploited in spring and slower growing members are exploited in summer and autumn.

Saugers from all sampling stations exhibited positive growth patterns that were spatially consistent. These seasonal growth curves also displayed oscillations that occurred about every 4 - 7 weeks. Pauly (1984) described a method for fitting seasonally oscillating length - growth data that accounts for accelerated growth during summer and slow winter growth. The biological implications of growth oscillations during the summer are not apparent in the Red River case.

Relatively strong cohorts of freshwater drum, saugers, walleyes, yellow perch and white bass were produced in the mid and late 1970's during years in which the vernal flow rates of the Red River and the warming rate of water in the river and Lake Winnipeg were relatively high. The relationship of strong walleye and sauger cohorts and

favourable environmental conditions is quantified and described in more detail by Lysack (1986).

Since the characteristics of percid stocks in the Red River are very similar to those of the southern Lake Winnipeg percid stocks, we can probably assume that Red River stocks are not discrete and originate from Lake Winnipeg. The autumnal upstream movement of walleyes is probably induced by the thermal gradient created by warm river water entering cool lake water. Thus, it is impossible to evaluate the suitability of present percid creel limits. The removal of freshwater drum and centrarchids by Red River anglers should be encouraged since there is mounting evidence that fish community dominance is shifting from percids to centrarchids in the Red River - Lake Winnipeg complex. Recent dramatic increases in abundance of freshwater drum in this system are due to recent increases in turbidity caused by anthropogenic activities along the Red and Assinibone valleys. Increasing dominance by centrarchids is directly related to excessive percid harvests by both anglers and commercial fishermen.

It is strongly recommended that the Red River sport fishery should be monitored more frequently and intensively to ensure that creel limits are not abused as observed by creel survey personnel. Walleyes are highly preferred by many anglers in spite of the fact they are not the dominant species. Many anglers return two or three times during a day to remove two or three creel limits of walleyes and saugers.

Relatively few anglers utilize areas upstream from the Lockport dam since the preferred species are uncommon in these waters. The development of new angling areas along the river's shores both upstream

and downstream from the Lockport dam may alleviate the crowding problems observed at Lockport. Areas of the river occupied by emergent vegetation should be protected since they are heavily utilized by forage stocks of emerald shiners.

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APPENDIX C

ANOVA of daily angling effort.

ANOVA testing for effects of day type, locations, and location x day interactions on daily angling effort.

Day type	Location	Blocks					
		May 15	May 22	June 5	June 19	July 17	Aug. 4
Saturday	Lockport	828	1176	1503	630	480	840
	Selkirk	369	2232	1116	795	201	465
	Netley	189	492	366	309	195	315
	Σ	1386	3900	2985	1734	876	1620
Sunday	Lockport	975	1506	726	1863	759	948
	Selkirk	918	2904	1090.5	2484	1473	1107
	Netley	477	579	147	1152	543	384
	Σ	2370	4989	1963.5	5499	2775	2439
	Total	3756	8889	4948.5	7233	3651	4059

	Lockport	Selkirk	Netley	Σ
Saturday	5457	5178	12313	12312
Sunday	6777	9976.5	3282	20035.5
Σ	12234	15154.5	4959	32347.5

Source	d.f.	SS	MS	F
Main plots				
Days	1	1657012.565	1657012.565	4.246
blocks	5	4222936.815	844587.363	2.16
error	5	1951291.81	390258.362	
Sub plots				
Location	2	4594532.378	2297266.189	18.23*
day x location	1	621656.372	621656.372	4.93*
error	20	2519669.75	125983.4875	

* significant at P=0.05

Treatment means and standard errors

Location (± 144.9)

	Lockport	Selkirk	Netley	Means (± 147.2)
Saturday	909.5	863	279.5	684
Sunday	1129.5	1662.75	547	935.2
Means (± 19.5)	1019.5	1262.875	413.25	

HISTOGRAM OF SELKIRK EFFORT

LOW	HIGH	N	(* to 2)
0.000	0.100	1	***
0.100	0.200	10	**********
0.200	0.300	7	*******
0.300	0.400	18	******************
0.400	0.500	14	**************
0.500	0.600	10	**********
0.600	0.700	6	******
0.700	0.800	4	****
0.800	0.900	4	****
0.900	1.000	1	***
1.000	1.100	2	******
1.100	1.200	2	******
1.200	1.300	1	***
1.300	1.400	0	
1.400	1.500	1	***
1.500	1.600	0	
1.600	1.700	1	**********
1.700	1.800	0	
1.800	1.900	0	
1.900	2.000	0	
2.000	2.100	0	
2.100	2.200	0	
2.200	2.300	3	******************************
2.300	2.400	2	********************
2.400	2.500	1	**********
2.500	2.600	0	
2.600	2.700	1	**********
2.700	2.800	0	
2.800	2.900	0	
2.900	3.000	1	**********
3.000	3.100	0	
3.100	3.200	1	**********

HISTOGRAM OF **EAST LOCKPORT EFFORT**

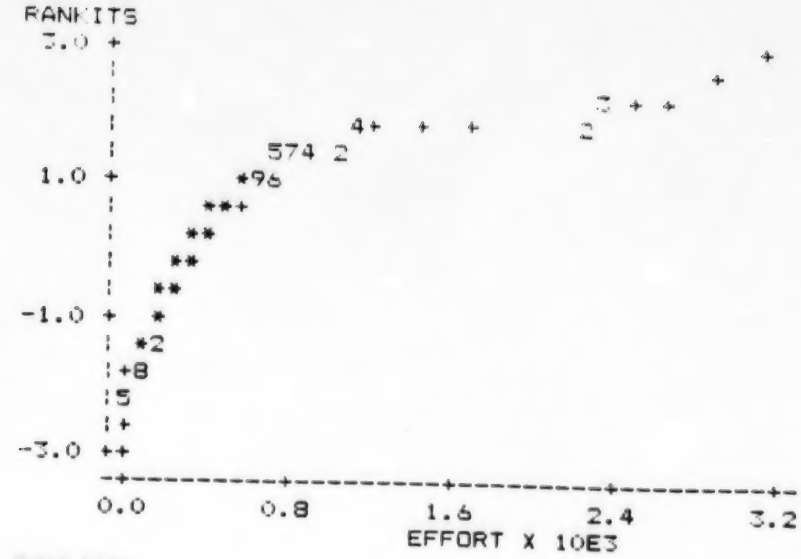
```
  LOW      HIGH   (X 10^3)
        N
---------------
 0.000    0.100 |****
        2       |****
 0.100    0.200 |
        0       |
 0.200    0.300 |**********
        9       |**********
 0.300    0.400 |**************************************************
       23       |**************************************************
 0.400    0.500 |************************
       10       |************************
 0.500    0.600 |************
        5       |************
 0.700    0.800 |**
        1       |**
 0.800    0.900 |****
        2       |****
 0.900    1.000 |
        0       |
 1.000    1.100 |**
        1       |**
```

HISTOGRAM OF **WEST LOCKPORT EFFORT**

```
  LOW      HIGH
        N
---------------
   0.0    100.0 |**
        1       |**
 100.0    200.0 |******************
       12       |******************
 200.0    300.0 |**************************************************
       33       |**************************************************
 300.0    400.0 |************************
       15       |************************
 400.0    500.0 |********
        5       |********
 500.0    600.0 |**
        1       |**
 600.0    700.0 |******
        4       |******
 700.0    800.0 |**
        1       |**
 800.0    900.0 |**
        1       |**
```

HISTOGRAM OF NETLEY EFFORT

LOW	HIGH	(X 10^3) N	
0.000	0.100	23	**********
0.100	0.200	27	**********
0.200	0.300	6	******
0.300	0.400	11	**********
0.400	0.500	3	***
0.500	0.600	2	**
0.600	0.700	0	
0.700	0.800	2	**
0.800	0.900	0	
0.900	1.000	0	
1.000	1.100	0	
1.100	1.200	1	*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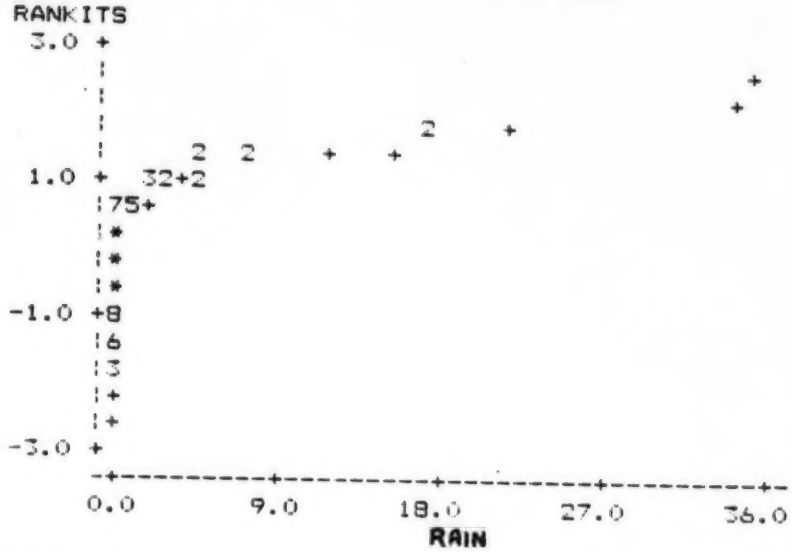
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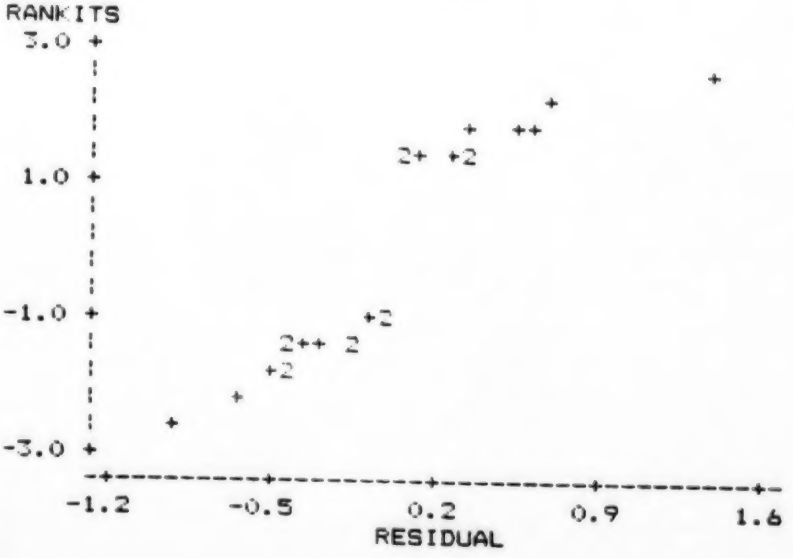
RANKITS
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-1.0
-3.0
-1.2
-0.5
0.2
0.9
1.6
RESIDUAL

APPENDIX D

Spring, Summer and Fall age-specific frequencies and mean body size of fish species retained by Red River anglers.

Table D1. Age-specific frequencies, mean lengths and mean weights of walleyes angled in spring (May-June), summer (July-August) and, fall September-October), 1982 at the three sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	2	3	277.33	18.67	253.33	56.96
		3	16	308.31	7.02	330.63	20.15
		4	9	352.00	17.12	511.11	37.14
		5	2	395.00	31.00	670.00	210.00
		6	3	510.67	25.96	1440.00	181.48
		7	1	490.00	-	1300.00	-
	Summer	3	4	306.50	5.06	275.00	15.00
		4	3	366.00	1.15	526.67	6.67
	Fall	3	2	317.00	19.00	310.00	30.00
		4	6	385.50	8.30	640.00	42.27
		5	4	376.00	9.66	590.00	41.23
		6	2	516.00	4.00	1560.00	60.00
		8	1	594.00	-	2960.00	-
Selkirk	Spring	1	1	222.00	-	100.00	-
		2	1	260.00	-	140.00	-
		3	50	301.86	3.45	283.20	10.65
		4	53	349.85	4.54	449.62	19.78
		5	14	393.14	11.04	615.71	41.73
		6	6	466.00	11.99	1056.67	60.75
		8	1	566.00	-	1720.00	-
	Summer	1	2	228.00	6.00	110.00	10.00
		2	2	253.00	15.00	180.00	20.00
		3	3	310.00	6.43	316.67	20.28
		4	6	343.00	10.41	423.33	41.77
		5	10	358.20	2.10	500.00	11.25
		6	4	420.75	11.54	827.50	97.59
		7	1	470.00	-	1200.00	-
		8	1	498.00	-	1530.00	-
	Fall	3	9	306.89	10.18	322.22	32.18
		4	25	359.92	6.19	534.40	24.99
		5	42	406.93	3.74	783.33	21.45
		6	73	466.33	3.22	1170.96	24.33
		7	62	515.97	3.59	1686.85	37.86
		8	48	565.54	4.77	2367.71	58.93
		9	19	607.68	4.31	3018.95	73.10
		10	8	648.50	6.43	3685.00	116.22
		11	3	656.67	31.55	3678.33	490.21

Table D1. Cont'd.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Netley	Spring	3	1	279.00	-	200.00	-
		4	4	309.00	6.66	292.50	31.98
		5	4	346.00	15.06	435.00	52.99
		6	4	391.00	18.43	592.50	88.26
		7	1	462.00	-	1010.00	-
		8	1	476.00	-	1355.00	-
		10	1	634.00	-	2400.00	-
		11	1	672.00	-	3000.00	-
		12	1	658.00	-	3150.00	-
	Summer	2	1	254.00	-	160.00	-
		3	5	264.40	9.15	200.20	14.63
		5	4	359.75	7.58	513.75	43.75
		6	6	414.33	15.48	762.67	80.67
		7	1	472.00	-	1136.00	-
	Fall	6	4	435.50	6.13	947.50	46.61
		7	1	478.00	-	1160.00	-
		8	1	560.00	-	2290.00	-

Table D2. Age-specific frequencies, mean lengths and mean weights of brown bullheads angled in spring (May-June), summer (July-August), and fall (September-October), 1982 at the three sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	3	2	235.00	25.00	240.00	70.00
		4	1	240.00	-	310.00	-
		5	1	272.00	-	340.00	-
		6	3	259.33	32.46	336.67	121.97
		7	3	310.67	14.85	500.00	51.96
	Summer	3	3	268.67	21.67	320.00	50.33
		5	1	304.00	-	440.00	-
Selkirk	Spring	3	3	224.67	2.91	203.33	3.33
		4	1	256.00	-	240.00	-
		5	3	258.00	9.87	313.33	46.67
		6	1	310.00	-	380.00	-
	Summer	3	1	208.00	-	180.00	-
		6	1	350.00	-	660.00	-
		7	1	300.00	-	400.00	-
Netley	Spring	2	9	221.11	4.81	176.67	6.72
		3	16	257.44	5.04	255.63	14.31
		4	35	297.00	4.08	398.89	12.37
		5	16	315.06	2.78	517.88	19.69
		6	3	332.00	4.87	691.67	6.72
	Summer	2	1	216.00	-	136.00	-
		3	10	292.00	4.17	391.10	10.03
		4	14	312.29	4.27	471.57	19.11
		5	8	325.75	4.57	575.38	30.96
		6	1	348.00	-	765.00	-
	Fall	4	2	322.00	8.00	520.00	40.00
		5	6	327.00	6.23	531.67	38.07
		6	2	349.00	13.00	695.00	55.00

Table D3. Age-specific frequencies, mean lengths and mean weights of freshwater drum angled in spring (May-June), summer (July-August) and fall (September-October), 1982 at the three sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	2	1	228.00	-	130.00	1.10
		3	7	268.86	21.20	262.86	1.23
		4	1	292.00	-	280.00	1.12
		5	21	328.05	3.14	448.57	1.26
		6	56	352.05	3.84	586.43	1.34
		7	224	372.76	1.51	692.86	1.34
		8	458	387.93	.89	820.32	1.40
		9	439	403.00	1.00	946.65	1.43
		10	325	412.09	1.40	1041.94	1.47
		11	136	428.16	2.46	1179.85	1.48
		12	30	447.27	7.30	1396.67	1.57
		13	9	481.33	5.23	1695.56	1.52
		14	6	529.00	10.01	2181.67	1.46
		15	4	512.50	8.18	2085.00	1.55
	Summer	2	1	210.00	-	120	-
		3	1	230.00	-	160	-
		4	5	271.20	15.72	226	14.00
		5	11	287.09	13.90	269.09	17.81
		6	20	334.60	23.87	477.50	25.32
		7	21	370.43	22.31	723.33	21.01
		8	38	381.79	28.00	801.58	20.80
		9	23	415.13	24.82	1074.78	35.44
		10	16	426.13	22.79	1176.88	52.20
		11	8	441.00	14.62	1316.25	61.18
		12	1	484.00	-	1640.00	-
		14	1	500.00	-	1732.00	-
	Fall	5	2	279.00	9.00	270.00	30.00
		6	4	345.25	11.15	590.00	64.55
		7	2	366.00	26.00	730.00	210.00
		8	6	365.33	5.08	733.33	30.40
		9	7	400.57	5.98	962.86	19.24
		10	12	414.00	3.93	1130.00	38.24
		11	1	490.00	-	1200.00	-
		12	2	442.00	20.00	1660.00	140.00
Selkirk	Spring	4	1	294.00	-	280.00	-
		5	20	330.05	9.08	475.50	62.62
		6	58	349.40	3.16	568.14	14.84
		7	151	372.82	1.66	687.81	10.08
		8	334	386.81	1.08	805.84	7.07
		9	301	405.71	1.55	961.55	11.20
		10	206	415.10	2.09	1047.07	16.11
		11	101	431.35	3.21	1190.89	27.24

Table D3. Cont'd.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Selkirk	Spring	12	51	458.59	6.45	1455.69	61.12
		13	18	480.33	9.74	1692.22	95.99
		14	10	487.10	11.82	1805.00	127.71
		15	13	556.00	16.54	2655.38	226.65
		16	2	578.00	16.00	2650.00	50.00
		18	1	640.00	-	3560.00	-
	Summer	2	5	206.40	6.27	98	12.00
		3	12	244.00	7.99	188.33	23.06
		4	35	284.00	2.49	266.86	9.16
		5	43	315.79	2.97	389.53	10.58
		6	42	345.40	4.78	520.48	14.37
		7	53	371.77	3.43	677.55	13.56
		8	60	395.02	2.11	881.50	14.43
		9	39	417.31	3.07	1043.08	17.33
		10	18	436.89	4.80	1222.22	44.86
		11	4	456.00	13.14	1427.50	141.50
		12	4	502.00	10.03	1645.00	156.50
		13	3	507.33	20.54	1773.33	113.92
		14	3	538.67	2.40	2346.67	37.12
		15	1	536.00	-	2320.00	-
		16	1	588.00	-	2500.00	-
		17	2	635.00	29.00	3475.00	495.00
	Fall	2	1	180.00	-	70.00	-
		3	1	252.00	-	200.00	-
		4	2	290.00	10.00	265.00	45.00
		5	4	333.00	10.63	477.50	45.89
		6	2	358.00	4.00	675.00	25.00
		7	4	360.00	6.48	722.50	31.98
		8	8	399.25	4.63	951.25	38.93
		9	5	417.60	5.84	1160.00	69.07
		10	1	412.00	-	1140.00	-
		12	1	530.00	-	2645.00	-
Netley	Spring	5	6	309.83	6.98	366.33	24.59
		6	11	333.64	7.33	480.45	34.66
		7	55	350.80	2.40	582.13	14.87
		8	196	376.95	1.25	726.30	8.13
		9	202	398.25	1.20	889.20	8.44
		10	163	412.39	1.61	1013.27	11.38
		11	66	339.29	2.76	1226.85	19.69
		12	34	462.32	6.84	1538.12	105.04
		13	17	490.53	9.44	1670.47	71.83
		14	14	496.79	10.79	1886.07	89.18
		15	8	555.63	11.62	2638.75	97.13

Table D3. Cont'd.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Netley	Spring	16	3	566.00	11.02	3125.33	267.10
		17	2	560.00	12.00	2725.00	185.00
		18	2	583.00	33.00	2815.00	465.00
	Summer	2	6	214.33	11.04	102.50	14.01
		3	11	251.09	17.30	242.18	63.39
		4	15	278.67	2.89	244.53	8.85
		5	30	315.93	3.69	381.73	15.89
		6	43	338.72	2.37	498.98	10.32
		7	37	366.16	3.00	643.86	14.31
		8	67	382.94	3.45	771.82	16.58
		9	23	403.65	3.88	920.87	18.41
		10	16	434.75	5.57	1198.88	34.35
		11	5	447.60	6.14	1336.00	57.67
		12	1	460.00	-	1260.00	-
		13	2	475.00	1.00	1569.00	169.00
		14	2	518.00	18.00	1935.00	415.00
		15	2	572.00	8.00	2382.50	492.50
		16	2	621.00	19.00	3060.00	430.00
	Fall	2	1	200.00	-	100.00	-
		5	6	298.00	6.30	270.00	20.66
		6	1	322.00	-	560.00	-
		7	2	361.00	11.00	665.00	85.00
		8	3	380.00	4.16	783.33	40.96
		9	2	411.00	9.00	1110.00	90.00

Table D4. Age-specific frequencies, mean lengths and mean weights of catfish angled in spring (May-June), summer (July-August) and fall (September-October), 1982 at the three sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	12	2	736.00	36.00	5625.00	125.00
		13	3	714.00	8.08	5150.00	835.00
		14	12	737.00	9.45	6480.00	324.00
		15	15	738.93	7.99	6460.00	245.00
		16	13	756.46	10.03	7327.69	301.73
		17	8	765.00	13.07	7331.25	421.02
		18	1	740.00	-	7000.00	-
	Summer	14	1	726.00	-	6000.00	-
	Fall	2	2	206.50	3.50	120.00	0.00
		3	1	264.00	-	260.00	-
		5	1	360.00	-	700.00	-
Selkirk	Spring	7	1	384.00	-	680.00	-
		13	2	726.00	6.00	6600.00	180.00
		14	1	772.00	-	7200.00	-
		15	4	731.00	27.78	6180.00	740.59
		16	1	728.00	-	6660.00	-
	Summer	2	1	204.00	-	100.01	-
		3	1	222.00	-	100.00	-
		12	1	738.00	-	6540.00	-
		13	4	669.00	32.13	5445.00	929.78
		14	3	702.67	13.38	5973.33	110.96
		15	2	759.00	25.00	7380.00	720.00
		16	1	740.00	-	7160.00	-
		17	2	793.00	43.00	8310.00	1110.00
	Fall	5	1	254.00	-	180.00	-
		13	1	796.00	-	8190.00	-
		15	2	761.00	13.00	7520.00	40.00
Netley	Spring	6	3	357.00	39.15	631.67	183.63
		7	1	422.00	-	1070.00	-
		15	2	755.00	15.00	6267.50	27.50
		16	1	743.00	-	7540.00	-
	Summer	5	2	346.00	16.00	510.00	80.00
		7	1	350.00	-	480.00	-
		11	1	504.00	-	1785.00	-
		13	1	700.00	-	6115.00	-
		14	2	711.00	53.00	7215.00	1755.00
		15	2	753.00	17.00	7330.00	670.00
		16	2	743.00	49.00	7167.50	1582.00

Table D5. Age-specific frequencies, mean lengths and weights of white suckers angled in spring (May-June), summer (July-August) and, fall September-October), 1982 at two sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	3	3	255.00	7.00	220.00	0.00
		4	3	351.33	13.97	623.33	112.89
		5	3	398.00	22.72	953.33	207.95
		7	1	400.00	-	920.00	-
		8	1	460.00	-	1160.00	-
	Summer	3	1	320.00	-	420.00	-
		4	1	372.00	-	780.00	-
		5	1	364.00	-	660.00	-
		7	1	406.00	-	780.00	-
	Fall	3	1	416.00	-	1180.00	-
Selkirk	Spring	3	1	372.00	-	720.00	-
		4	1	364.00	-	740.00	-
		5	1	456.00	-	1380.00	-
	Summer	5	1	400.00	-	1020.00	-
	Fall	3	2	411.00	11.00	940.00	10.00

Table D6. Age-specific frequencies, mean lengths and mean weights of silver redhorse suckers angled in spring (May-June) and summer (July-August) 1982, at two sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	3	1	230.00	-	140.00	-
Selkirk	Spring	2	3	189.00	17.62	100.00	20.00
		3	2	297.00	33.00	380.00	120.00
		4	2	365.00	3.00	780.00	60.00
		5	1	360.00	-	700.00	1
	Summer	7	4	366.00	27.78	600.00	69.28
		8	5	380.40	12.72	716.00	93.68
		9	5	422.80	17.50	1196.00	179.04
		10	4	399.50	20.24	940.00	140.48

Table D7. Age-specific frequencies, mean lengths and mean weights of goldeyes angled in spring (May-June), summer (July-August) and fall (September-October), 1982 at the three sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	2	5	198.80	11.71	92.00	12.00
		3	359	246.76	.52	151.00	1.14
		4	564	257.05	.45	182.25	1.23
		5	83	270.99	1.32	227.30	3.16
		6	8	298.50	3.16	305.00	9.82
		7	1	266.00	-	200.00	-
	Summer	1	1	166.00	-	30.00	-
		2	10	231.60	6.56	120.00	8.94
		3	1841	258.73	.22	197.92	.66
		4	587	267.59	.41	224.61	1.28
		5	12	296.00	4.77	310.00	17.49
		6	2	323.00	3.00	400.00	-
	Fall	3	10	276.60	4.19	230.00	8.56
		5	1	312.00	-	360.00	-
Selkirk	Spring	2	10	211.30	7.47	96.00	8.84
		3	82	250.99	1.35	172.32	3.59
		4	16	276.75	4.69	252.50	20.50
		5	1	310.00	-	260.00	-
		8	1	420.00	-	1080.00	-
	Summer	2	4	204.00	3.27	125.00	1.63
		3	17	247.06	14.65	176.47	3.55
		4	7	264.14	11.60	224.29	4.38
		5	1	316.00	-	320.00	-
		6	1	328.00	-	340.00	-
	Fall	2	3	217.33	5.70	106.67	6.01
		3	2	257.00	11.00	165.00	25.00
		4	3	268.67	4.37	220.00	15.28
		5	1	306.00	-	380.00	-
Netley	Spring	2	5	208.40	7.93	92.00	9.82
		3	58	246.78	1.56	163.97	3.30
		4	10	267.80	3.85	214.00	7.92
		6	1	316.00	-	370.00	-
		9	1	412.00	-	1060.00	-
	Summer	2	6	208.00	2.25	170.67	5.33
		3	14	243.86	4.64	663.15	6.88
		4	11	272.91	6.87	854.85	8.82
		5	1	310.00	-	-	-

Table D7. Cont'd.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Netley	Summer	6	1	352.00	-	-	-
	Fall	4	1	290.00	-	260.00	-

Table D8. Age-specific frequencies, mean lengths and mean weights of carp angled in spring (May-June), and summer (July-August), 1982 at the three sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	7	4	551.00	43.02	3450.00	738.49
		8	2	502.00	52.00	2390.00	610.00
		9	4	523.50	42.00	2635.00	629.68
		13	2	675.00	55.00	6000.00	2000.00
		14	4	628.00	10.03	4460.00	565.63
		15	1	654.00	-	5540.00	-
		16	2	648.00	40.00	6230.00	1770.00
		17	2	600.00	64.00	4570.00	1630.00
	Summer	17	2	679.00	11.00	6100.00	260.00
Selkirk	Spring	4	1	266.00	-	460.00	-
		7	1	562.00	-	3920.00	-
		8	1	612.00	-	3100.00	-
		10	1	406.00	-	940.00	-
		11	1	602.00	-	3980.00	-
		12	1	606.00	-	4680.00	-
		13	3	618.00	18.58	4436.67	225.12
	Summer	3	1	218.00	-	200.00	-
		10	1	558.00	-	2980.00	-
		12	1	622.00	-	4980.00	-
		14	1	676.00	-	5220.00	-
Netley	Spring	7	1	434.00	-	1530.00	-
		8	2	492.00	58.00	2225.00	575.00
		9	3	535.67	26.33	2523.33	237.51
		10	10	570.20	11.92	3392.10	199.94
		11	3	660.33	14.68	5905.00	269.92
		12	2	722.00	12.00	7800.00	700.00
		13	1	656.00	-	7250.00	-
		14	1	720.00	-	8010.00	-
	Summer	2	1	216.00	-	230.00	-
		3	2	258.00	4.00	382.00	2.50

Table D9. Age-specific frequencies, mean lengths and mean weights of yellow perch angled in spring (May-June), summer (July-August) and fall (September-October), 1982 at two sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Selkirk	Summer	2	1	136.00	-	80.00	-
	Fall	2	1	202.00	-	140.00	-
Netley	Spring	2	1	184.00	-	70.00	-
		3	6	210.33	-	130.00	
		4	8	230.50	-	173.13	-
		5	4	249.00	-	222.50	-
	Summer	2	11	176.82	5.05	85.91	15.39
		3	7	214.71	13.54	129.29	13.11
		4	4	226.00	9.83	179.00	13.70
		5	1	260.00	-	246.00	-
	Fall	3	1	198.00	-	126.00	-
		4	1	246.00	-	220.00	-

Table D10. Age-specific frequencies, mean lengths and mean weights of mooneyes angled in spring (May-June, 1982 at Lockport on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	2	1	184.00	-	80.00	-
		3	1	200.00	-	100.00	-
		4	4	264.75	17.20	195.00	32.27
		5	2	257.50	7.50	245.00	45.00

Table D11. Age-specific frequencies, mean lengths and mean weights of northern pike angled in spring (May-June), summer (July-August) and fall (September-October), 1982 at two sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	3	2	335.00	105.00	435.00	145.99
		5	1	520.00	-	900.00	-
		6	1	588.00	-	1580.00	-
	Summer	2	1	310.00	-	210.00	-
		3	1	374.00	-	380.00	-
		4	4	447.00	6.56	615.00	
		5	1	560.00	-	1280.00	-
		6	2	558.00	18.00	1310.00	130.00
		7	1	530.00	-	100.00	-
		8	1	586.00	-	1320.00	-
	Fall	3	2	349.00	69.00	370.00	90.00
		4	1	514.00	-	1000.00	-
		7	3	609.33	59.33	1720.00	420.00
		8	1	636.00	-	1820.00	-
		10	1	844.00	-	4460.00	-
Netley	Spring	3	2	547.50	4.50	1165.00	55.00
		4	4	501.25	18.80	813.00	89.80
		6	1	673.00	-	2170.00	-
		7	1	708.00	-	2750.00	-
	Summer	4	1	520.00	-	996.00	-
		7	1	792.00	-	4185.00	-

Table D12. Age-specific frequencies, mean lengths and mean weights of rock bass angled in spring (May-June), summer (July-August), 1982 at two sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	3	1	222.00	-	280.00	-
		4	3	210.00	2.31	230.00	10.00
		5	1	220.00	-	260.00	-
		6	1	218.00	-	290.00	-
		7	1	188.00	-	180.00	-
		8	1	218.00	-	260.00	-
Netley	Spring	3	1	197.00	-	105.00	-
	Summer	3	1	170.00	-	135.00	-
		5	1	240.00	-	356.00	-

Table D13. Age-specific frequencies, mean lengths and mean weights of burbot angled in spring (May-June) and fall (September-October), 1982 at two sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Selkirk	Fall	3	2	458.00	68.00	1140.00	110.00
		4	1	528.00	-	1300.00	-
Netley	Spring	1	1	288.00	-	180.00	-
		3	1	450.00	-	650.00	-
	Fall	3	1	430.00	-	680.00	-

Table D14. Age- specific frequencies, mean lengths and mean weight of white bass angled in spring (May-June), summer (July-August) and fall (September-October), 1982 at the three sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E
Lockport	Spring	2	2	212.00	8.00	180.00	0.00
		3	1	214.00	-	180.00	-
		5	2	227.00	13.00	180.00	40.00
		6	3	338.00	10.07	653.33	59.25
		7	3	371.33	6.96	853,33	70.55
		9	2	345.00	5.00	760.00	6000
	Summer	2	1	222.00	-	210.00	-
		3	2	244.00	8.49	265.00	7.07
	Fall	2	2	192.00	4.00	105.00	5.00
		3	5	236.00	14.18	252.00	53.89
Selkirk	Spring	3	1	238.00	-	220.00	-
		5	1	332.00	-	740.00	-
		7	1	360.00	-	920.00	-
	Summer	1	1	182.00	-	100.00	-
		2	5	195.60	17.84	145.00	37.28
		3	4	255.00	7.90	252.50	35.44
		4	1	280.00	-	380.00	-
	Fall	2	7	196.00	4.49	137.71	9.44
		3	1	258.00	-	360.00	-
		4	2	280.00	2.00	445.00	25.00
Netley	Spring	2	3	204.33	4.70	143.33	14.81
		3	1	230.00	-	200.00	-
		5	1	354.00	-	840.00	-
	Summer	2	5	251.20	3.44	267.00	15.12
		3	1	250.00	-	295.00	-

Table D15. Age-specific frequencies, mean lengths and mean weights of sauger angled in spring (May-June), summer (July-August) and fall (September-October), 1982 at the three sampling sites on the Red River.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Lockport	Spring	1	6	210.33	3.36	81.67	6.01
		2	216	233.26	.93	118.89	1.46
		3	607	257.95	.69	172.31	1.51
		4	109	291.67	1.84	260.00	4.29
		5	3	331.33	7.51	366.67	6.67
		6	2	353.00	41.00	490.00	170.00
	Summer	1	8	195.25	10.80	85.63	9.23
		2	431	238.05	.69	129.90	1.19
		3	1910	263.93	.39	184.57	.88
		4	349	298.01	1.08	276.06	2.85
		5	21	328.76	2.57	370.95	8.78
		6	3	365.33	165.33	540.00	69.28
		7	1	404.00	-	720.00	-
		10	1	458.00	-	460.00	-
	Fall	2	116	246.22	1.08	145.52	2.03
		3	1953	279.28	.38	218.21	.96
		4	502	312.51	.64	314.22	1.97
		5	18	360.33	2.53	503.33	13.26
		6	3	376.00	5.29	560.00	30.55
		7	1	422.00	-	860.00	-
Selkirk	Spring	2	39	230.41	1.98	107.44	2.96
		3	125	256.70	1.80	174.48	3.73
		4	19	286.95	5.27	275.26	8.03
	Summer	2	30	225.63	2.16	111.00	3.01
		3	193	264.04	1.25	193.52	2.91
		4	43	301.58	2.75	293.81	5.49
		5	4	339.00	6.56	385.00	12.58
		6	1	356.00	-	450.00	-
	Fall	2	26	238.46	1.51	124.62	2.49
		3	289	276.30	1.01	208.76	2.39
		4	124	307.95	1.16	298.73	3.60
		5	12	347.33	2.83	431.67	16.46
		6	1	396.00	-	700.00	-
Netley	Spring	2	24	234.08	2.27	117.92	5.81
		3	134	264.80	1.47	184.80	3.51
		4	23	299.74	2.01	276.70	6.71

Table D15. Cont'd.

Station	Season	Age	No. of Fish	Mean Length (mm)	1 S.E.	Mean Weight (gm)	1 S.E.
Netley	Summer	2	13	224.46	4.23	106.54	7.60
		3	37	253.46	3.37	166.19	7.21
		4	3	300.00	11.55	226.67	15.90
		5	3	321.33	17.14	313.33	33.83
		6	1	374.00	-	470.00	-
	Fall	2	1	238.00	-	150.00	-
		3	11	273.64	5.28	209.64	12.14
		4	2	300.00	10.00	280.00	20.00
		5	1	312.00	-	350.00	-